

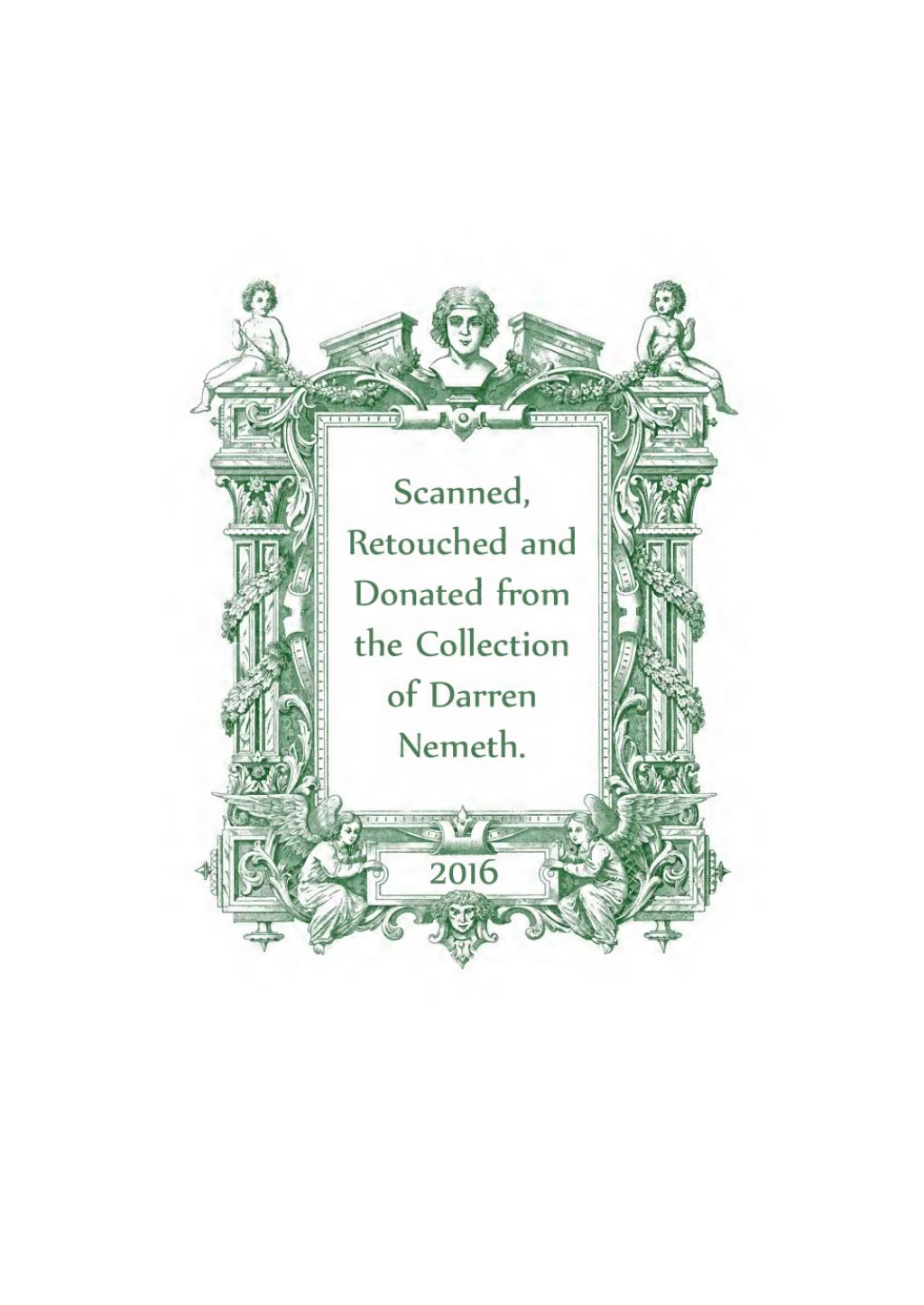
MOVIE MAKING Made Easy

SECOND EDITION

Price 50 Cents

William J. Shannon

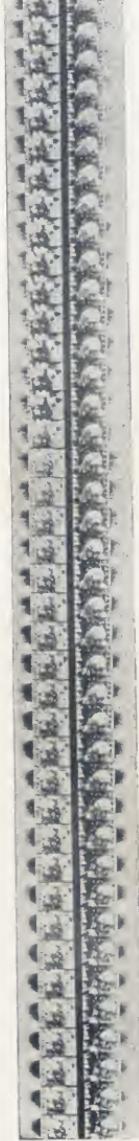




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MOVIE MAKING MADE EASY



Photos by Eastman Kodak Co.

The various widths of motion picture film, 35, 16 and 8 millimeter, from which the amateur may select his medium.

MOVIE MAKING MADE EASY

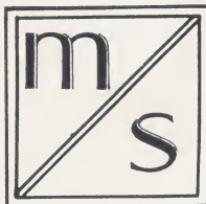
A Handbook for the Amateur Movie Maker
Who Would Make the Best Use of
His Equipment

By

WILLIAM J. SHANNON

Author of "Home Movie Gadgets Any Amateur Can Make,"
"Amateur Movie Production," "How to Make Money
With a Movie Outfit," "Money Saving Tips
For Movie Makers," "Camera Trails
Through the Southwest," etc.

WITH 24 ILLUSTRATIONS



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PREFACE TO EIGHTH PRINTING OF SECOND EDITION

When the first edition of "Movie Making Made Easy" appeared, it was immediately hailed by amateur movie makers all over the United States and Canada as a much needed practical handbook written in the language of the amateur. In fact, copies of the first edition have been bought by many movie makers in England, France, Germany, Norway, Holland, Egypt, India, Syria, Australia, Argentina, Mexico, Samoa, China and Java, testifying to the universal appeal of the movie hobby and the interest of amateurs all over the world in this fascinating pastime.

When this second edition was presented in October, 1935, in a new format and at a much lower price, it won instant support. To date 14,000 copies of the new edition have been sold, and the continued support of movie makers and newcomers in the movie field indicate that it will continue to sell steadily for some time to come.

Since the appearance of the first edition, an entirely new field has been opened for the amateur movie maker—color photography without expensive equipment. Keeping up with this new advance in amateur cinematography, details on the Kodachrome and Dufaycolor processes make their appearance in this edition.

Thanks are again due to George H. Scheibe, Charles G. Williamson, T. F. Hunter, Lewis E. Ashley, Dr. Clarence W. Winchell, O. B. Larson, Jr., L. Otis Wright, William J. Koen, Eastman Kodak Company and Dufaycolor, Inc., for material used in the preparation of the original edition and this revised edition of the book.

December, 1937

WILLIAM J. SHANNON.

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CHAPTER I

SELECTING THE CAMERA

MOST amateur movie makers who are now advanced in the hobby started as still photographers. They took up movie making because of a desire to see their pictures "live."

To be a good movie maker, however, one need not first be a good still photographer. Some experience with still photography, of course, will be of use to the novice in the movie field. A knowledge of light values, exposures, composition, etc., is always helpful.

Because motion picture lenses and films are so much faster than the average still camera lens, the movie maker, coming from the still ranks, really has to learn film and lens speed all over again.

The movie maker coming into the amateur field today has a greater choice in the matter of cameras and projectors than those of us who took up the hobby ten years ago. While 16 millimeter film (abbreviated 16mm. hereafter) has been adopted as the standard amateur width by the majority of camera and projector manufacturers catering to the amateur trade, just as the 35mm. film was adopted as standard theatre width, several manufacturers have introduced other widths, notably the Pathe 9½mm. and the 8mm. film.

AMATEUR HAS CHOICE OF FOUR WIDTHS—Therefore, the amateur of today has his choice of four widths of film. Serviceable 35mm. cameras have been developed for the amateur experimenter, but because of the great cost of 35mm., requiring a master negative and a positive print (since reversible film has not been adapted to that field), this width is impractical for any except the very advanced amateur or the amateur to whom expense is of no concern.

The 8mm. film and the 9½mm. width have their advantages of cutting the cost of amateur movie making to a min-

imum. They also have their disadvantages, the least of which is the smallness of the picture they project. This picture size, while entirely adequate for home use, is not quite suitable for school, church, or auditorium use if the amateur hopes to go in for that work.

The 8mm. film has a single row of perforations on the side of the film. The 9½mm. has a single perforation in the centre of the film and at the base of each frame. Difficulties are sometimes encountered when perforations are broken. Nevertheless, the 8mm. field is attracting a large number of amateurs because of its economy.

The 16mm. film on the other hand, with its two rows of perforations, can still be serviceable if some of the perforations are broken on one side.

COMPARISON OF FILM SIZES—A glance at the frontispiece will show the size of each of the three most popular widths of film available to the amateur. His choice of the width he prefers to work in rests entirely with him, depending upon the amount of money he wishes to expend for his equipment.

Roughly, the advantages and disadvantages of the four widths of film based on the standard running time of 16 minutes per reel, may be summarized thusly:

35mm., or standard theatre size, costs about \$30 per thousand feet of negative. Developing the negative costs another \$15 or \$20. A positive print for projection costs another \$30. Therefore, a minimum cost of \$75 or \$80 per reel of 1,000 feet of projection film must be counted in this field. Four hundred feet of 16mm. film which runs just as long as the 1,000 feet of 35mm. film, on the other hand, costs only \$12 to \$20, depending upon the quality of film desired. When you add the cost of the large reel and humidor can necessary to store the 35mm. film, it is readily seen why this width is beyond the average amateur's purse.

An investment in 2,000 feet of film must be made to obtain 1,000 feet of projection film. This film is inflammable and cannot be unprotected during projection as can the amateur

cine safety film. The reason is that the 35mm. film is made on a nitrate base; the amateur film on an acetate base. The running time of this film at the average projection speed of 16 frames per second is 16 minutes. The film is approximately 1 $\frac{3}{8}$ inches wide.

ADVANTAGES OF 16 MILLIMETER SIZE—To run 16 minutes of 16mm. amateur standard film, only 400 feet of film are required. The reason is obvious. Sixteen millimeter film is only one-third as wide as 35mm. or $\frac{5}{8}$ of an inch. Shortening the width also shortens the depth so that while 35mm. film has 16 frames to the foot, 16mm. has 40 frames to the foot. Multiply 400 feet by 2 $\frac{1}{2}$ and you have the equivalent of 1,000 feet of 35mm. film. The running time of 400 feet of 16mm. film likewise is 16 minutes when projected at a speed of 16 frames per second.

The Pathex 9 $\frac{1}{2}$ mm. film reduces considerably the amount of film needed to obtain the same projection time, but it is an odd size. It is very popular in Europe, however. Special camera and projector are needed for this size film.

8 MILLIMETER WIDTH—The 8mm. film, on the other hand, is half the amateur standard width, but needs only one-fourth the amount of 16mm. film to run for 16 minutes, or 100 feet. A comparison of the 16mm. frame size and the 8mm. size shown in the frontispiece will easily fix this in your mind.

While 8mm. cuts the frame width of 16mm. in half, it also cuts the frame depth in half. In other words, one frame of 16mm. is equivalent to four frames of 8mm.

By an ingenious arrangement in the 8mm. camera, regular 16mm. film is used in 25-foot lengths, doubly perforated. Only one half the width of the 16mm. film is exposed. When the 25 feet have been run through the camera, the film is reversed and sent through the camera again, this time the other half of the 16mm. film being exposed. When the film is processed, it is slit down the middle and the two pieces spliced. It is returned to the movie maker as a 50-foot length of 8mm. film and when projected runs just as long as a 100-foot roll of 16mm. film, or four minutes. It has but one row of perforations.

This explains how 25 feet of 16mm. film can equal 100 feet of 16mm. film when used in the 8mm. camera. Therefore, only 100 feet of 16mm. film are needed to obtain 16 minutes of projection time. The Bell and Howell Company has placed upon the market a straight 8 camera, using film perforated on only one side.

AMATEUR FILM IS SAFETY FILM—The reversible 8, 9½ and 16mm. films are all safety films, made on an acetate, non-inflammable base, and may be safely projected anywhere without danger of fire. The film need not be enclosed in a fire-proof projector housing, as is the case with the average 35mm. film. This feature, aside from its low cost, is one of the biggest in its favor. Its low cost is due to the reversal process. The film which the amateur uses in taking his pictures is the same film which is returned to him processed and which he uses for projection. The reversal process which turns an original negative back into a positive, all on the same film, will be explained in a later chapter and instructions will be given for the amateur who would like to experiment with the process himself. It is quite simple, once it is explained.

For an all around film medium for amateur work, 16mm. offers the best advantages to the movie maker. Its low cost and adaptability, compared to the large clear pictures it is capable of projecting (up to 5 by 7 feet if needed, depending upon the light value of the projector used), and the fact that it can be handled easily for home processing when the amateur advances to that stage, are features which commend it highly to the serious amateur movie maker.

For that reason, most of the production and mechanical suggestions offered in this book are intended primarily for the 16mm. movie maker, though they can be adapted to include 8, 9½ or 35mm. work where needed.

Film making is one of the most absorbing of hobbies. The wide variety of uses to which it can be put makes it ever interesting and ever adaptable to the movie maker's requirements.

The amateur movie maker is circumscribed in his field only by the limitations of his equipment. And a resourceful film maker can overcome even this handicap.

CHAPTER II

CARE IN CAMERA WORK

 ONE of the most important functions in good movie making is the proper loading and unloading of the camera. More trouble and spoiled film can be caused here than in any other part of film making. Therefore, some words of advice on the proper procedure are appropriate.

When loading and changing the highly sensitive panchromatic and supersensitive films, or even the slower semi-chromatic films, attention should be given to the following precautions in the use of the 16mm. camera.

The film is guarded at each end by about five feet of paper or film leader and trailer, perforated exactly like the film. It is the leader and trailer (and the light-tight reel) which make daylight loading of the film possible, preventing light from entering during either operation.

LOADING CAMERA—It is recommended that loading and changing be done by weak light and under no circumstances should the operation be performed in direct sunlight. If no shaded place is available when the film is being loaded or changed, throw a coat or other shield over the camera to prevent the sunlight falling upon the film.

Full directions for the loading of the camera are furnished by the manufacturer, but they are repeated here in case the amateur who has newly acquired his equipment has neglected to study them carefully. A thorough understanding of the correct method of loading and changing the film will save many feet of light-struck and useless pictures.

Remove the roll of film from the carton in which it is supplied. Most manufacturers protect unexposed film by enclosing it in a two-piece steel container. This not only protects the film from being accidentally exposed to light, but also protects the reel from being bent and the film damaged when it is returned to the processing station.

Have the camera open and ready to receive the new film. Keep the take-up reel handy also. Take the outer cover off the roll. The spool, together with the inner case is then placed on the spindle provided in the camera. The spool has one square hole and one round one so it is impossible to place the reel on the spindle in the wrong manner. The side marked with a star will come uppermost. Care should be taken when the spool has been put in place that the springs or rollers provided in the camera for holding the protecting strips in place are properly arranged. Be sure that the flange, or spring tension, which guides the footage indicator, rides on the film proper.

After removing the inner case, the leader is unwound about 18 inches. This will bring it to the word "stop." Thread the leader on the upper sprocket, through the gate and under the lower sprocket. Be sure to follow the guide lines indicating the proper upper and lower loops. A short loop may cause the pull-down claws to jam the film.

Insert the free end of the leader in the take-spool. Give the spool two or three turns to the right to be sure that the leader is properly engaged. The take-up spool should always be of the kind with solid disks. Some spools have perforated disks, but these do not keep out the light and are intended only for the projection of the finished film. Under no circumstances should you use these spools in the camera.

The take-up spools should be perfect in every respect. If the spool has been bent by dropping it or otherwise damaged, it is liable to cause the film to jam.

TESTING THE THREADING—Before placing the cover on the camera, run the mechanism for six or eight inches to be sure that the film has been properly threaded and is running smoothly. If it has jumped off a sprocket, the sprocket teeth will perforate the film and ruin it, or that part of it which runs through before it eventually jams. If the paper leader is punctured no great harm has been done and it can be re-threaded easily.

When the operator is assured that the film is running smoothly through the various mechanisms, the cover is re-

placed and the camera is ready for action. Set the footage indicator at the star, or other point provided on the camera, and run off the paper leader until the indicator points to 100 (or 50 in the case of a film of that length).

When the whole film has been exposed, care should be taken that the protecting trailer is fully wound on the take-up spool so as to prevent the film from being light-struck when removing it from the camera. With a little experience, the operator can tell the moment the last of the trailer passes through the film gates and on to the take-up reel. Do not run the camera any longer, as there is danger of loosening the protecting trailer and exposing the last few feet of the film to light when it is removed from the camera.

After opening the camera, place the inner case as quickly as possible over the take-up spool, remove it from the camera and place the cover over the spool. The cover is slotted to fit the square in the reel and make the container light-proof. Films made for use in the tropics are sealed in a tin can. This can should be saved and the film replaced in it and bound with adhesive tape before returning to the processing station. This precaution is taken to prevent the film from spoiling in the humid tropic climate.

PROTECT TAKE-UP REEL—Replace the steel reel which originally contained the unexposed film on the take-up spindle. This will serve as the take-up reel for the next film. Keeping it in the camera will protect it from being bent or mislaid.

Place the metal case containing the exposed roll of film in the cardboard container and print your name and address plainly in the spaces provided for it. All the cartoons contain the name and address of the manufacturer to whom it is to be returned for processing.

Tie the carton securely with a piece of heavy cord and mail it to the nearest processing station indicated by the film maker, or take it back to the dealer nearest you and it will be returned to the manufacturer. Do not seal the carton unless you wish to pay first class postage rates on it. The several manufacturers making amateur motion picture film are offering forty-eight hour service within 300 miles, so you

should get your film back in a few days. The purchase price of the film also includes the cost of processing and return postage. Some film makers provide a negative and return both the negative and a positive print after processing.

Again let it be emphasized that the carton should contain your name and address printed in plain block letters. That is the only record of ownership the processing station possesses, since the owner's name is not written on the reel or paper leader. The film itself is usually perforated with a number and the same number is perforated on the box containing your name and address. In this way the processing station can keep a record of the film and return it to the proper owner after processing.

DUPLICATES OF REVERSAL FILM—Any number of copies of negative film may be made by a processing station. So also with the reversal film, but it is recommended that the movie maker send films for duplicating before the original film has been shown too many times, otherwise there might be irreparable scratches upon it.

All 16mm. cameras, with the exception of some foreign makes, are built to take film lengths of 50 and 100 feet. Whichever roll you are using, be sure to set the indicator arm inside the camera to accommodate that particular roll. Also watch the footage indicator if you are using a 50-foot roll, as the starting mark appears half way down the meter. If a 50-foot roll is used, make certain that a 50-foot take-up spool is employed. Do not use a 100-foot take-up reel as this causes considerable confusion at the processing station. Each new camera comes equipped with both the 50 and 100-foot empty aluminum spools for use with either footage.

WHY FILM JAMS—Some of the causes of film jamming in the camera are:

1. The operator has failed to follow the guide lines in the camera and has made the upper and lower loops too short.
2. Film has unraveled on feed reel or has failed to ride on guides.
3. The operator has failed to see that the film perforations are being engaged properly by the sprocket teeth and riding smoothly through the gate.

4. The operator has neglected to close the upper or lower sprocket guide movements.

5. The pull-down claws have torn the film or damaged it in some other way.

6. Improper threading of take-up spool has caused film to fail to wind up as it unreels. (This can be caused also by breakage of the spring belt, though this is a rare occurrence in new equipment.)

7. The take-up spool has been bent, causing the film to loop on the outer edge of the spool rather than wind up on the spindle base.

8. The interior arm of the footage indicator has been bent, the spring broken, or in some manner interfered with the smooth release of the feed reel. (This will also cause the pull-down claws to reduce the upper loop and jam the film flush against the gate, possibly tearing it.)

If any of the above causes of jamming are experienced by the movie maker, he need not immediately conclude that the whole film is ruined. If the camera can be put aside until night, or if a dark room is available, only a few feet will be lost which can be deleted when the film is returned from the processing station.

However, if the operator must open the camera in daylight, he will do well to throw a cloth or coat over the camera before opening it, providing a makeshift shield from the light.

After the film has been released from the "jam," wind a foot or two on the take-up reel and re-thread, making sure everything is in order before closing the camera. Then run off eight or ten feet of film before making a scene, as that amount probably will be spoiled by being exposed to light however slight. This portion can be deleted when editing.

CAUSES OF UNSATISFACTORY PICTURES—The Agfa-Ansco Corporation of Binghamton, N. Y., has developed a novel "trouble sheet" which it returns with each processed film. The sheet contains a list of 22 causes of trouble and the film inspector merely has to punch the number to indicate wherein the amateur has made mistakes in photography. The list is valuable because it gives the amateur a clue to his mis-

takes and gives the procedure for avoiding them in his next effort.

The list of troubles and means of correcting them follows:

1. Scenes under-exposed—appear too dark; too small diaphragm stop or insufficient light used.
2. Scenes over-exposed—appear too light: too large a stop or excessive amount of light used.
3. The beginning of film fogged—appears clear: too much of the protective leader unwound at time of loading camera.
4. The end of film fogged—appears clear; camera opened before protective trailer wound around exposed film.
5. Film edge-fogged—edges appear clear: camera loaded or spool handled in direct brilliant light.
6. Some scenes indicate camera was moved too rapidly.
7. Film is scratched, foreign matter accumulated on film-gate; focal plane, sprocket guides or other parts of camera touching film.
8. Frame lines of pictures are dirty; aperture (aperture border) of camera dirty.
9. Scenes show reflections: pictures taken with lens pointing directly to source of light.
10. Film unsharp: ordinarily due to inaccurate focusing or lens not tightly screwed in its seat, or covered with dirt or moisture.
11. Film shows continuous blur, "ghost" or double image: film moved while shutter was open. Film improperly threaded into camera, imperfection in claw or shutter movement, or particles of dirt in film-gate.
12. Black area in frames: finger or object in front of lens at time of exposure, obstructing its view.
13. Pictures unsteady: hand-crank camera used without support or taken from moving vehicle.
14. Film shows static: film dried out while in camera or during storage in unusually dry atmosphere.
15. Film wholly unsharp and under-exposed: threaded into the camera with red side of paper leader (black shiny side film in the case of film without paper leader) to lens instead of black side (dull side of film), and consequently the exposure was made through the base, causing corresponding unsharpness and under-exposure in the pictures.

16. Film is fogged in places: camera was opened accidentally, probably without owner's knowledge.

17. Film is black: not exposed or extremely under-exposed.

18. Film is fogged at intervals: a projection reel was used as take-up spool.

19. End of film fogged—appears clear: the protective trailer was separated when removing film from camera.

20. Film scratched—loops too large: film stuck against the camera side or spool.

21. Close-up pictures not properly centered (parallax): allowance was not made for the difference in the field covered by the camera lens and the view finder of the camera.

22. Pictures appear somewhat "flat"—lack "snap": due to direct front or backlighting.

CHAPTER III

THE CAMERA'S EYE

 T must not be assumed that the purpose of this chapter is to analyze all lenses from the simplest snapshot variety up the scale to the peak of excellence occupied by the super-products of some of our manufacturers. Perhaps it should have been dedicated to the novice who has just gotten over the first thrill of seeing himself on his own screen and has begun to wonder just what happens inside the camera. Let us, for the present, confine our attention to the fundamental laws which govern the functioning of that vital element, the lens, the heart and soul of every still or movie camera. This item is the guiding factor to real pictures but, as it happens, is taken for granted longest, and frequently no attempt is made to understand it at all.

Pictures can be and have been taken without the use of a lens. It is a fact that an image can be reproduced on a sensitive film enclosed in a dark exposure chamber and allowed to receive light rays entering through a small hole pointed toward the object to be reproduced.

Why, then, is it necessary to employ a lens in taking pictures?

A film is sensitized to respond to light rays given off by the light source itself or from any object capable of reflecting a sufficient amount of that light. All light rays used in photography are necessarily reflected rays except when we have eclipses and such to drag us from conventional paths. We are, in most cases, actually using the sun indirectly to project a picture into the exposure chamber where the film acts as a screen to receive it. The amount of light is, therefore, wholly dependent upon the reflecting quality of the subject and directly proportional to the intensity of that reflection.

The matter of focus is not considered here as the film will receive light rays from any reflecting object within visibility. The trouble is that the tiny aperture admits such an infin-

itesimally small amount of light that it would require an intensely bright source to produce a picture of appreciable clarity.

CHANGE OF FOCUS—We were suffering from a scarcity of light on our film, so let us place a small magnifying glass in the aperture and see if we can sufficiently amplify our light to give us an image bright enough to be within the scope of our sensitized film. We do this and what happens?

We lose the magnificent depth of picture which we had at first and find that, while we have captured more illumination, we have deflected our light rays to definite points within the exposure chamber. We have also set up different points therein for each plane of detail in the subject and find that a definite relation now exists between the distance from the subject and the lens and its conjugate distance between the lens and the film. Should there be another detail of the subject farther from the lens than the main subject, say a tree, such as a bush or house, its light rays would not converge within the exposure chamber at a point coincidental with those at the point of the subject.

To get a clear impression of the bush or house we must vary the distance between the lens and the film, so as to bring the film to the point of convergence. In doing this we lose the image of our original subject. This is a definite law of optics and necessitates what is called "change of focus."

The distance from the lens to the film is varied by moving the lens toward or away from the film rather than changing the position of the film. Without going into any technicalities at this time, we will say that this focal distance is governed by the best working distance of the lens as determined in manufacturing.

REASON FOR INVERTED IMAGE—The position of the image on the film being reversed and inverted is due to the fact that the light rays emanating from the subject follow the same line that your vision would if you were perched in the top of the tree and looking through the aperture. You would see the bottom portion of the film. Likewise, looking from the base of the tree you would see the upper portion of the film.

LENS ABERRATION—In the attempt to increase our light by the use of a lens we find ourselves confronted with many undesirable features, such as parasitic characteristics of the lens itself. The first of these are Chromatic and Spherical Aberration. These two characteristics go hand in hand and are particularly noticeable in single lenses. The curvature of the crystal, while giving us a slight convergence of spectrum, leaves us with the question of which light frequency we wish to focus on our film. The violet rays, tending to follow a shorter path to the optical axis, converge at a point nearer the lens than the blue; the green beyond the blue. The red, being the lowest in frequency, is the least affected by the prismatic influence and therefore assumes a point of convergence at the extreme focal length of the lens. This is called Chromatic Aberration.

Now, to forget color frequency for a while, consider only the beams of white light entering the aperture. These are passing through our lens at all points of its area. Those passing through the centre follow the optical axis, thereby having no convergence. Those passing through at a point slightly away from the centre will focus at their normal convergence, while the rays entering around the edge of the lens seem to have a deplorable tendency to meet at a point quite close to the lens itself. This is known as Spherical Aberration.

Such is the theoretical condition brought about by the use of the simple double convex lens. Needless to say, we are no better off than we were without it as we have done nothing but accumulate a considerable mess of hash to impress on our film.

SECONDARY LENS—Before we throw the whole works in a heap let us stop and think how we got this way. If prismatic influence caused all this trouble, perhaps by reverse English we can make it correct itself. The correction for both of the above troubles is made in a single step by the use of a secondary or negative lens, known as a Double Concave, placed immediately behind the first. This combination is called an Achromatic or Aplanatic lens.

We make chromatic correction by exerting a reversing effect on both ends of the spectrum and bring our light frequen-

cies to a common plane. We make spherical correction by a divergence of marginal beams away from the axis without interfering with those entering near the centre.

CORRECTING ASTIGMATISM—This secondary lens is also valuable in its ability to correct a third evil which we have not, as yet, spoken about. Astigmatism, that strange phenomenon which makes its presence known by the failure of a lens sharply to define vertical and horizontal lines simultaneously when in the same focal plane. This is not so noticeable at or near the centre of the field, but around the margins there will be a tendency to favor one or the other and an individual focus is necessary to bring either to a definite outline. This change of focus is called the degree of Astigmatism and is not to be confused with either of the aforementioned aberrations as they are more or less theoretical while Astigmatism is a visible defect. It is sometimes called Distortion.

This is erroneous, however, as Distortion is really another story and is in a class by itself. This characteristic is a noticeable bending inward of marginal straight lines when the aperture is between the lens and the subject. This is the "pin-cushion" effect, so called because the image of a postage stamp would be of such shape. On the other hand, if the aperture were between the lens and the film, the image of the stamp would assume a "barrel" effect with the same lines bulging outward at the margins.

It will be noticed that with all the above irregularities, the most bothersome are those having to do with marginal light rays. In the cheaper lens equipment these defects are often partially remedied by the use of a lens larger in diameter than the largest aperture, thereby cutting off the troublesome marginal effects.

LENS FORMATIONS—This is only a makeshift measure, however, and is not resorted to by the better lens manufacturers. In complete lens assemblies fitted for use in standard mounts space is an important factor and they are made up with the variable aperture placed between two lenses, thereby neutralizing the distortion of one by the counter-distortion of the other. Thus we finally arrive at a point where the film

receives an image fully corrected as to color frequency and light distribution.

MEANING OF LENS "SPEED"—A lens that is called "fast" is merely one whose effective aperture is in closer relation to its focal length than ordinarily exists. This admits more light rays and consequently impresses a more brilliant image on the film. The definition f:3.5 expresses the relation existing between the aperture and the focal length, which is a fixed quantity such as 1, whether it be inches, centimeters, or what have you. We are not interested in the unit of measure just so that we know the relation between it and the effective aperture.

This relation is obtained by dividing the diameter into the focal length of the lens. In a still camera where the distance from the plane of the lens to the centre of the film or plate is 4 inches and the largest diameter stop is 5 inches, the "speed" or light-ratio of our lens is taken from the expression 4.5 or f:8.

Likewise in movie cameras where focal distances are much shorter, an f:2.5 lens is one whose maximum opening multiplied two and one half times will equal the distance from the plane of the lens to the plane of the film.

CHAPTER IV

TRICK PHOTOGRAPHY

WHEN the amateur has exhausted the possibilities of family subjects and casual shots around the home, he looks forward to doing something a little more difficult than mere "snap-shooting."

He has read or heard about the many interesting tricks which can be performed with the camera and casts around for some instructions on how to go about making such trick shots. This chapter will detail a few for his guidance. There are plenty more, but these few apparently mystifying tricks will do for a start.

REVERSE ACTION SHOTS—The commonest and most favored trick is the one known as "reverse action." As its name implies, this is merely a means of making the subjects of the pictures perform their action backwards. A favorite stunt of the trick photographer is to flash on the screen a picture of a friend diving naturally off a diving board into the water, then flying feet first back through the air to the diving board, whence he started. Perhaps you have seen this trick on the professional screen and wondered how it was accomplished. It's quite simple when it is explained, as are all tricks.

You can make it yourself this way: Photograph the scene with your camera held UPSIDE DOWN. When you get the film back from the processing station, that portion of it which has been photographed upside down is cut out of the main reel, TURNED END FOR END and spliced back into the strip. This reverses the action of the subject, but keeps it upright on the screen.

An amusing reverse action effect can be obtained at the scene of blasting operations, particularly when an exceptionally large amount of earth is to be moved by the blast. The operator, from a safe distance, of course, photographs the scene UPSIDE DOWN from the time the plunger, which sets off the explosive, is pushed, until all the dirt and debris which has been thrown into the air settles to the ground. When the

scene is processed and reversed, end for end, the spectator sees on the screen rocks and great masses of dirt and debris rise from the surface of the ground into the air and fly back to a common meeting ground where they unite to form a bank, hill, or whatever object was originally blasted away.

Still another amusing effect can be gained in this manner by standing on the back platform of a speeding train and photographing the track behind the camera UPSIDE DOWN. Reversed, on the screen, the scene has the effect of having been made from the front of the locomotive and the spectators will wonder how you ever obtained permission to ride on the front of the engine. Let them wonder. Don't spoil it by telling them the truth.

STOP MOTION SCENES—"Stop motion" pictures prove another amusing diversion that is easily possible with your cine camera. This is done by stopping the camera in the midst of action and having the actors hold their places while other actors are introduced in the scene, or while some of those who took part before the camera was stopped leave the scene. For example, a man and a girl are walking down the street toward the camera. At a signal from the camera man, they both stop, simultaneously with the stopping of the camera. The man holds the position he was in when the camera was stopped and the girl leaves the scene. Another man enters and assumes the position held by the girl. The camera is started again and the scene completed. On the screen, if it is properly worked out, the girl and man will be seen walking toward the camera. Suddenly, and for no reason at all, the girl will disappear and in her place will be a man. The effect is heightened if the second man is dressed to represent a tramp or a policeman.

One trick the writer worked out and which never fails to get a laugh is this: A man in evening clothes poses as a magician. He produces all sorts of rabbits, hats, pipes and even persons, apparently out of the air. All done by stop motion of course. He closes his act with six girls appearing seated in rapid succession as he waves his wand.

Another trick that produces laughs is this one. A man, wearing a derby hat, is standing before a white sheet back-

ground. He places his thumbs in his vest sleeves and rolls a cigar in his mouth. As he does so his derby hat automatically slides to the back of his head. Then the hat begins to do a crazy dance on his head, moving from one side to another and finally rises three inches above his head, all without aid of the subject's hands which are on his vest. The trick is funny and simple to do. A person behind the sheet manipulates the hat on instructions from the camera man. The derby was used because it was easy to get a grip on the stiff brim.

With the newer cameras equipped with half-speed, or eight frames per second, up to 64 frames per second for slow motion, unusually interesting tricks can be achieved. By using the half-speed button, and photographing the action at a busy street corner, some startling effects will flash upon the screen. The half-speed device reduces the taking of the pictures to half normal, and doubles the normal screen speed. Rush hour traffic appears with lightning speed upon the screen.

SLOW MOTION—The slow motion speed enables the amateur to achieve some interesting results and is invaluable for studying golf, tennis or diving form. And it enables the amateur to catch some action, as the flight of birds, that it is difficult to photograph at normal speed.

Great care should be exercised when using the half-speed or slow motion speeds of the cine camera. The half-speed device doubles the exposure given to each frame of film and the lens aperture, therefore, should be shut down accordingly. The same care should be used with the slow motion speed of 64 frames per second. With this speed the film needs four times the normal exposure. Watch the compensations needed for the various speeds. These are usually attached to the camera by means of a metal plate.

DOUBLE EXPOSURE—There are various devices available to the amateur movie maker for trick work. One of these is the special lens which distorts the subject and makes him appear very short and fat on the screen. Another lens enables a subject to talk to himself on the screen. This is done by exposing one-half of the film, rewinding in a dark room, and then exposing the other half. This trick can also be done with a matte box.

A matte box that will fit on the front of your camera is needed. In either side of this box and about three inches out from the front of your lens it will be necessary to cut slots to allow the insertion of mattes. These two mattes must slide in an equal distance to the centre and join. Take care that the matte box is built to exclude light and it must be painted dull black on the inside. Likewise the mattes must be painted black in order that no light is reflected. This matte box can be held rigidly in place by fastening to the tripod or by taping firmly to the front of the camera.

Select the place to take the double exposure. Suppose it is a lawn table with the subject to be seen sitting on both sides of the table at the same time and talking to himself. It is imperative that the camera be mounted on a rigid tripod which must not be moved from the time the first exposure is made until the second one is completed. Place your subject on one side of the table, facing the opposite end of the table. The centre of the table is the centre of the picture as seen in the finder.

Now insert one matte to cover the opposite half of the scene to be made. Be careful that the matte slides in until it is in alignment with the centre of the lens, thus covering just half of the picture. Only half of the scene in which your subject appears will be photographed.

It is best to start with a new roll of film. Make as much of the scene as you wish. After you have finished the first half, it is obvious that it is necessary to have the film returned to the starting point to make the second exposure. Here is where you may experience a little difficulty, as only the custom built amateur cameras are equipped to reverse and run the film back to the starting point with the shutter closed, as in the professional camera.

But the film can be returned to the starting point in this manner:

First, note the exact reading of the footage dial and mark it down. Place a cap over the lens and run the balance of the film through. Remove the film from the camera, as you would a completed roll and take into a dark room. If you

are using panchromatic or supersensitive film, you will have to do your rewinding in the dark, as these types of film are sensitive to both red and green light. However, if your re-wind is ready, you will have no trouble.

When the roll of film is ready for replacing in the camera, be careful not to move the camera while re-threading it.

Insert the opposite matte until it just meets the one used first. Remove the first matte and you are ready to make the second half of your scene. In this, of course, place your subject on the other side of the table and have him face his original position. Expose your film to the point where the indicator read when you stopped the first scene. That's all there is to making double exposures. Your film, when projected, will show your subject seated twice at the same table and talking to himself.

CHAPTER V

CARE OF THE PROJECTOR

AS in the chapter on camera selection, no attempt will be made to influence the movie maker in the selection of any particular type of projector. The one whose price best meets his resources is the one he most likely will buy. There are many good ones on the market at reasonable prices. Naturally, those with 500 or 1,000 watt lamps cost more to buy and operate, but they give the maximum screen brilliance and long range projection. This is especially desirable when a large picture is needed in an auditorium or church hall.

For home use, however, a projector that will fill a screen 30 by 40 inches or 39 by 52 inches, brilliantly, will be more than ample for the amateur's needs.

Having purchased his projector, whatever its make, he must now treat it carefully so that it will give him good usage over a long period of time. Hence this chapter.

CLEANING FILM GATE—The importance of keeping the film gate of the projector clean cannot be too strongly emphasized. As the film passes through the gate, particles of emulsion are shaved off, dust and grit accumulate and have a tendency to throw the film off register.

The gate can be cleaned with a moistened toothpick. Do not use a sharp instrument as there is danger of chipping or scratching the metal. Such burrs, however slight, may cause scratches on the film which it will be impossible to remove. Small abrasions on the gate offer a base for the deposit of grit or emulsion.

Clean up the sprocket wheels also. If too much dirt adheres to the sprockets or the gate, a swab of cotton moistened with alcohol will remove such adhesions.

A projector should be carefully cleaned and oiled each time it is used. This not only protects the film from picking

up foreign substances, but gives a more clearly projected image on the screen.

Remove the condensing lens occasionally and thoroughly polish it with a lintless piece of linen or a lens cloth made for the purpose.

The projection lens and reflecting mirror (if you have that type of projector) should always be cleaned before using the projector.

OILING—In oiling the movable parts of the projector, be sparing in the use of oil. Each part to be oiled is clearly marked. A drop of good grade sewing machine oil at each friction point is all that is necessary thoroughly to lubricate the projection machinery for one showing. Do not use a heavy oil, as it may congeal in the intervals between use. A heavy oil may considerably slow down the smooth operation of the projector. Many manufacturers are now including their own special oil with their projectors.

It is also a wise precaution to clean the projector thoroughly about twice a year, from the lamp to the motor. If you do not feel competent to take the projector apart for such cleaning, your dealer will be glad to have his service department do it for you at nominal cost.

FOCUSING THE PROJECTION LAMP—Projectors using Type T10 prefocused lamps, after being in use for some time, often lose a great deal of the light they are capable of throwing on the screen by being jarred or misplaced after cleaning.

Most of these lamps are installed in the lamp house by a clamp around the base of the socket, held by two screws. Should these screws not be drawn up tightly when replacing lamp in socket, or on reversing same, the position of the socket may be changed and cause the lamp to set too low or too high with relation to the condensing lens. Or it may set too far to the right or left, thus reducing the full efficiency of the lamp.

To focus these lamps properly, proceed in the following manner: Remove lamp for cleaning by pressing downward and turning in a counter-clockwise direction. The lamp will

be forced upward out of the socket. Be careful in handling not to jar the filament unduly, if the lamp has been in service for some time, as it becomes rather frail and is easily broken when approaching the end of its normal life. The manufacturers rate this type of lamp's burning life at 50 hours at the voltage specified on the lamp.

After removing, wipe the lamp carefully to remove all finger marks and dust and replace in socket. Remove projection lens and hold a square of white cardboard about six inches in front of the lens aperture. Turn on the lamp switch and you will see an image of the filament thrown on the square of cardboard as shown in the diagrams given here.

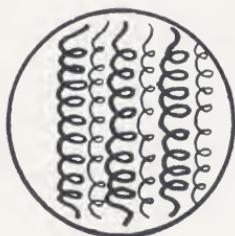


Fig. 1

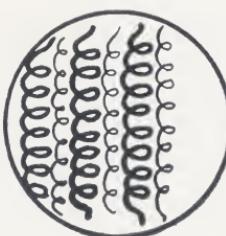


Fig. 2

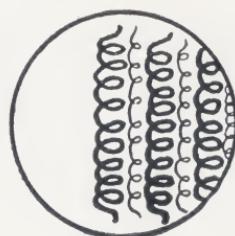


Fig. 3

Fig. 1—Focusing the projection lamp. Image correctly focused. Note reflected image. Fig. 2—Lamp set too far to right. Fig. 3—Lamp set too far to left.

In a correctly adjusted lamp, the image of the filament proper will appear on the cardboard to the left edge of the circle with the reflection from the mirror between coils and to the right as shown in Figure 1.

Should the image appear as in Figure 2 or Figure 3, then loosen the socket clamp screws and turn socket and lamp to right or left as required. If the image is as shown in Figure 4 or Figure 5, move the socket down or up to bring light to the position as shown in Figure 1.

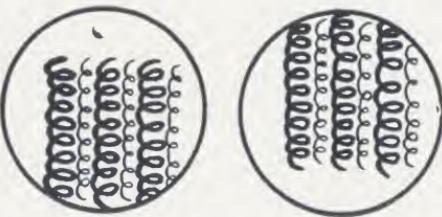


Fig. 4 ...Fig. 5
Fig. 4—Lamp too high. Fig. 5—Lamp too low. Socket misplaced.

CLEANING PROJECTION CONDENSERS AND LENSES—
Condenser and projection lenses should also be kept perfectly clean and free from finger marks. Projectors having an angular mirror between condensing and projection lenses require extra attention. This angular mirror should be removed and wiped clean of any accumulation of dust or oil before replacing.

A soft cloth wrapped around a match or a sheet of good photographic lens cleaning tissue is best for cleaning purposes.

No projection lamp is stronger than it is clean.

For clear and brilliant pictures, look to your projection lamp and condensing lenses.

CHAPTER VI

CARE OF FILM

HE movie maker should never allow film to remain uncovered for any length of time. The proper place for a reel of film is in the humidor can which fits neatly over the reel and contains a blotter or other device for keeping the film in a moist and pliable condition.

When the film is exposed to air and warm temperature, it dries out quickly. In addition to a slight shrinkage, it becomes brittle and there is a tendency for splices to pull apart when run through the projector.

Film humidors should be moistened about once every two months, even if the film has not been used during that time. All film should be cleaned after it has been run through the projector a dozen times. In passing through the gate, the film picks up particles of dirt and grit. Fingers also leave their oily deposits on the emulsion when handled during rewinding.

All these smears cut down light which passes through the film during projection. If you would have crystal clear pictures on your screen, you will be well repaid for the time it takes to clean the film.

There are several film cleaning liquids on the market, but some of them are rather expensive. All non-inflammable film cleaning liquids use carbon tetrachloride as a basic ingredient, because it dries instantly, does not shrink the film, nor mar it in any way.

Several of these liquids are put up for cleaning dresses, gloves and other articles, under different trade names. But you can buy a quart of carbon tetrachloride from your druggist or chemical supply house for a very small sum.

PROTECTING FILM—In cleaning film, use a cloth that will not scratch the sensitive emulsion. Odd pieces of velvet are ideal for the purpose. Saturate a small piece of cloth with

the cleaning liquid. Double the cloth over the film so as to clean both sides in one operation. Hold cloth in the left hand and rewind slowly with the right. Hold cloth lightly but firmly so that the film will travel through it without pull. The liquid will dry instantly and will not soften the emulsion.

Cleaning is a much slower process than ordinary rewinding, so don't hurry. Watch the cloth carefully. When it shows signs of becoming covered with grit, discard it and saturate a fresh piece with the liquid.

Continue this process until the entire reel has been cleaned. Then moisten the humidor can and store the reel. You can rest assured that it will be in excellent condition when you wish to use it again. You will be surprised to note how much brighter the pictures appear on the screen.

MARKING REELS—A piece of ordinary white adhesive tape about four inches long and half an inch wide placed on the small flange of the cover gives you an excellent place to mark the title of the reel. Use ink so the title will stand out clearly. If the titles of the reels are so marked, you can stand two dozen reels in an upright position within a space of twenty-four inches. In this position they take little room and any particular reel can be located in a second.

Two pieces of wood placed in parallel positions in the front and rear of the reels will hold them upright on a shelf or in a closet and prevent them from rolling forward or backward.

CHAPTER VII

FILTERS AND THEIR USE

RECKONING in dollars and cents, the use of what is known as the "filter" in motion pictures production has proved one of the biggest boons to the practical side of the motion picture industry; likewise the filter has served to enhance greatly the artistic possibilities of the cinema, and has placed within the range of the amateur the fine effects obtained in theatre pictures.

Before the lens it is very often the direct means of saving time and money involved in traveling long distances to special sections to obtain atmospheric effects, such as the typical London fog. A particular type of filter is used for fog effects. Professionally, such atmosphere is in continual production demand. The filter in this instance eliminates the necessity of waiting for fogs. The desired effects may be obtained with the fog filter when the sun is shining or when the light is good. Investigation has revealed that in many ways the fog filter brings more satisfactory results than are possible in filming of real fog, especially at night. The most powerful lights do well if they are able to penetrate the real fog without showing the straight cut searchlight effects that cannot be avoided.

TYPES OF FILTERS—Another type of filter with color gradation in various degrees, sometimes only one color, then again in two color combinations, the upper half red and the lower half yellow, is used to produce night effects at any time of the day. Clouds are retained in their natural tone or can be overcorrected so that the scene will appear as though shot in moonlight.

Night effects are made with various grades of graduated filters, the color combination depending upon the effect desired. These filters turn the blue sky as dark as wanted and the scene appears as if made at night, though it may have been made at noon. This, of course, is possible only on panchromatic film.

Diffusion is also obtained with a filter which produces the same effect as a soft-focus lens, and does not alter the exposure.

Other types of filters called "irises" are used in blending the edges of the picture in circular, oval and square effects, sometimes with black edging and again in white.

The amateur has followed in the footsteps of his big brother, the professional cameraman, and has succeeded in producing many of his tricks. Special effect filters, which have been made available for the amateur, have made this possible

USING THE COLOR FILTER—In outdoor photography where there are brilliant cloud effects, such as in marine or landscape scenes, and when certain of the weaker colors are present, the use of a color filter is necessary to bring out the best effects and prevent the film from having a "washed out" appearance.

The action of the color filter equalizes the effect the stronger colors have upon the light-sensitive film, during the period of exposure in the camera, by retarding the blue and violet rays. In this manner the weaker colors are given sufficient time to register on the film.

All amateur movie cameras are now made with flanges, screw settings, holders or other devices for attaching color filters. With panchromatic film it is absolutely necessary that a color filter be used to achieve the finest results of which the film is capable. This admonition, however, does not pertain to close-ups and portraits on panchromatic taken within five feet of the camera. In this latter case, the filter should not be used, as it causes an unnatural lightness on faces.

But in all other scenes, semi-close-ups, medium and long shots, seascapes, in fact wherever strong color contrasts appear, use the color filter for best results. The filter gave fairly good results when used in connection with the old orthochromatic film. It kept back the blue light, which photographs a chalky white or gray, and gave the clouds an opportunity to register. Orthochromatic film, however, is not as sensitive

to the various colors as is panchromatic, and the movie maker should not expect the same results from it even when working with a filter. Some manufacturers are no longer making orthochromatic film. A new and cheaper film has taken its place. This film will be discussed in a later chapter.

FILTERS INCREASE EXPOSURE—When the color filter is in position, exposure on orthochromatic film will require an exposure four times longer than would be given to it if no filter were used. This is automatically accomplished by setting the diaphragm scale indicator at the second larger diaphragm opening than would be used without the filter. For example, a landscape requiring a diaphragm opening of f.11 without filter, would require an f.5.6 aperture when the color filter is used.

On the other hand, if panchromatic film is used with the filter, the exposure would be just twice what would ordinarily be used on panchromatic without the filter.

Example:—A scene requiring a diaphragm opening of f.11 without filter, would require an f.8 opening when the color filter is used. Only double the exposure is needed in panchromatic film because of its superior speed and sensitivity to various colors. Other than this lengthening of the exposure time, in the manner described, no change is necessary in the operation of the camera.

SOFT FOCUS EFFECTS—There are many amateurs who would like to experiment with soft focus effects, so popular in professional pictures, but the lack of equipment or the cost of obtaining it has kept them from doing so.

Only a short time ago, there was no equipment such as manufactured screens or lenses for this work; the cameraman had to make his own. In fact, he was the originator of the idea. Then followed the manufacturing of special equipment such as lenses and filters. But, because of the cost, many amateurs would hesitate to invest to make a few experiments.

You can try out the soft focus effect with very little cost by a simple expedient. Visit a dry goods store and select a high grade quality of black silk gauze with a very even mesh.

It may be well to get several grades of weave. Many times you can pick up remnants at small cost.

With supersensitive film, which is twice as fast as panchromatic film in daylight and three times as fast in artificial light, the following rule should be applied: If the normal exposure with panchromatic is f:8 and with the filter f.5.6, then with supersensitive film the exposure can be cut down to t.11 without filter, and f.8 with filter.

It is not advisable to use a filter with artificial light, as every ray is needed to get good pictures. If the speed of your lens is such that you can cut down with supersensitive, do this, as the smaller the lens aperture the greatest the depth of focus, and consequently the larger the group which can be photographed in full details.

For ordinarily bright days, a K2 filter is sufficient to bring out good cloud effects. If you prefer a deeply contrasted sky for your outdoor scenes, use a K3 or K4 filter. The K6 is for overcorrection and should be used only for obtaining night effect scenes, as the blue light is so steadily retarded by this filter as to register almost black upon the film. An orange filter is very effective for air pictures and shots directly up into the sky.

The hardest part of the job is to make a holder to keep the gauze rigid before the lens. A piece of pasteboard mailing tube about two inches long and of a size to fit over the entire lens mount will work satisfactorily as a holder. This can be held in place by a small piece of adhesive tape. The gauze can be stretched over the end of the barrel and held in place tautly by a rubber band. The gauze should be one inch from the front combination of the lens for average use. Paint the interior of the barrel a dull black to avoid reflection directly on the lens.

The distance of this gauze, which is called a matte, from the front of the lens will govern the grade of softness imparted to the picture.

As the matte cuts down the exposure or amount of light reaching the film, it is necessary to compensate by allowing more exposure. Figure the normal exposure for the film you

are using. An exposure meter is an invaluable help. Then open the lens one stop wider to compensate for the light the gauze absorbs.

DIFFUSING THE EDGES—If you wish to create a sharp center and a diffused edge to your picture, this can be done by touching a lighted cigarette to the center of the matte and burning out the center. This permits the center objects to be clearly focused where interest is paramount, and the edges to be diffused. A matte of this kind is ideal for close-ups where the surrounding objects should not detract from the main subject.

Fog effects can be obtained by the same process, though a white silk is needed in place of the black gauze.

One point to remember is that the sun must not strike directly on the matte while photographing, otherwise it will cause the same trouble experienced when the sun strikes the lens proper.

CHAPTER VIII

EDITING AND TITLING

WHEN the still camera enthusiast acquires motion picture equipment, he is prone to carry with him into his new field the dictum of the "still" owner: "Push the button and let the finishing station do the rest."

To a certain extent this also holds true of amateur movie makers. The novice can press the button of his movie camera and the finishing station will return to him his processed film ready for projection.

But, unlike the spoiled negative in still photography which need not be printed, the 100-foot roll of film that goes through the movie camera is developed and reversed whether it is good or bad. All of this is on one strip when it returns to the photographer. It is then his task to properly edit the film by deleting the light-struck, over and underexposed scenes, scenes out of focus, or those in which the subject's head has been cut off, and the other work of editing, titling and splicing the film.

There are dozens of competent concerns which offer an editing and titling service. The amateur need only furnish them with a scenario and the copy for the titles and they will do the mechanical work of editing, titling and splicing the film.

But the amateur who fails to know the thrill of doing his own editing is missing more than half the fun of movie-making. If time is precious and money is no consideration, the amateur can have excellent work done by the professionals, just as the still photographer does. But he may as well employ someone to run his projector for him as far as his part in movie making is concerned.

It takes real effort to be your own cameraman, director, film editor, splicer, scenario writer, electrician and projectionist, but thousands of amateur movie makers throughout the

country are putting on this one-man show daily and getting a real kick out of it.

The final test of the amateur movie maker's skill lies not alone in photography, but in the careful editing and presentation of his pictures. Ingenious exposure meters simplify the problem of proper exposure to a remarkable degree, but only the amateur's knowledge of the fundamentals of cinematics makes his pictures a joy to behold on the screen.

This knowledge of cinematics and continuity is brought into play when the amateur takes the processed film and begins the arduous but pleasureable task of writing and making his titles and in carefully editing and splicing his film.

It is difficult for the amateur, especially the beginner, to throw away good film, however poorly exposed. He regards this as waste and includes the poor shots with the good ones. As a result the latter suffer and are not given a fair chance on the screen. The real waste is in careless exposure, not in discarding the resulting poor film.

If continuity is lacking and bad scenes are permitted to follow good scenes, the projected film is not only hard on the eyes of the audience, but is also confusing.

With the modern improvements in 16mm. motion picture equipment at the command of the amateur, the only difference between his pictures and those in the theatres lies in the editing, omitting, of course, the elaborate settings and costumes of the professional films. The lenses available to the amateur are in their field, equally as good as those made for the professional.

MEANING OF EDITING—The term editing, in a film sense, is akin to the same meaning in an editorial sense. The editor of a newspaper or magazine takes the manuscript, corrects it for punctuation and grammar, cuts out unessentials, gives a main title and intersperses it with subtitles and generally polishes it before presenting it for the approval of his readers.

The film editor cuts out the bad scenes, arranges the best scenes in their proper relation to one another (called sequence) and inserts effective subtitles where necessary to ex-

plain and carry the action forward in a smooth and comprehensive manner (called continuity).

If the amateur who has witnessed hundreds of professional productions in the theatres could get a glimpse behind the scenes, he would take heart and tackle his own films with renewed zeal. A professional picture in the making is much the same as an amateur scenic, photoplay or other film. There are bad scenes necessitating "retakes"; there is spoilage, anachronisms and unrelated scenes.

The professional photoplay, after shooting is finished, is a jumble of scenes totally unrelated, and without titles. The work of the director, the actors, the property and costume men and photographers is finished. Now comes the important job of editing.

The film cutters and editors take the scenario and begin to assemble a smooth-running continuity from this seemingly jumbled mass of film. The various scenes are timed and cut for proper effect in speeding up or slowing down action; bad scenes are eliminated or retaken, and subtitles are inserted, though not as much since the advent of sound. When the film cutters and editors get through with the film, it is a photoplay and ready for the audience—and not before.

Suppose the professionals were to shoot all their scenes, good and bad, splice them all together in haphazard fashion and send them to the theatres. How many persons could be induced a second time to witness such a conglomeration?

But that is exactly what the amateur movie maker asks his audience to do when he projects his films without editing them, or edits them in a slipshod manner.

ACHIEVING SMOOTHNESS—Mention has been made of continuity. This not alone applies to photography where the action and plot are of paramount importance, but to ordinary films such as the amateur would make. Continuity in the last analysis means smoothness. And smoothness in the amateur's films can only be attained by arranging scenes in proper sequence.

If you start off with a shot of the capitol at Washington and then jump to a shot of the Bunker Hill Monument in Boston and then back again to Washington, that is not continuity. The sequence is broken, thereby destroying the continuity.

The proper approach would be to show a long shot of the capitol then a medium shot of the dome, close-ups of the steps and possibly finish with a shot of the esplanade. The audience, viewing the picture, gets a comprehensive view of the whole sequence by progressive steps. Then, if you must jump to the Bunker Hill Monument, you may proceed to do so by making the transition with an appropriate subtitle.

Continuity builds up the film by successive related scenes, according to time, place or action. If a film contains scenes taken in all seasons, proper continuity would dictate that snow scenes be grouped together, summer scenes in sequence, etc. You will thus avoid the incongruity of watching someone in swimming in one scene and someone sleigh-riding in the next.

As editing is synonymous with cutting, it might be well to pause here a moment and more fully describe this term. Cutting refers to the operation of removing scenes that are over- and under-exposed, out of focus, shaky because of failure to hold the camera steady, or poorly panoramed scenes. If the scene is good in every respect and does not come under any of the above designations, it still can be cut—if it is too long.

Long scenes are monotonous. Five feet of film are enough for any scene where the action is not continuous. Shorter scenes help speed up such action, but be careful not to make them too short.

A scene may also be cut if it does not advance the total effect of the photoplay or other film which the amateur is producing. Do not splice in a shot of Uncle Joe just because it is a good picture of him. If it has no place in the reel, cut it and save it for the family album reel. (All movie makers should take advantage of their opportunity and collect a living pictures, it was the consensus of opinion among profes-
TITLES IMPROVE PICTURES—Prior to the advent of talk-ing record of their relatives in action.)

sional producers that good titles had much to do with the sources of motion pictures. The amateur can take a leaf from the professional's notebook and suit his titles to the type of scene he is editing. If it is a humorous scene, a witty title is in order; if it is otherwise, then humor may be in bad taste or offensive.

It is not difficult for the amateur to write appropriate titles. He is familiar with the characters and action, or scenes depicted, and should be able to produce descriptive but concise titles. Sometimes the names of places, people and dates on which the filmed action took place are valuable in keeping an accurate record for future reference.

There are various methods of editing film. Much depends upon the temperament, likes and dislikes of the movie maker. What may be a fairly easy system for one amateur may not suit the needs of another. An effort will be made to give the details of some of the better methods of editing film so that the amateur may choose one which is most agreeable to his particular inclination.

Some amateurs, and the author is among them, like to make a complete record of every scene they shoot. They use a small notebook ruled to show the date on which the scene was made, light conditions, the title of the scene, the exposure, footage and whether the scene was a long or medium shot, semi-close-up or close-up. This record is valuable in checking the results in the finished film. (Details for compiling a scene record book and diagram of same will be found in the last chapter.)

It is a source of interesting data on light conditions at certain times of the year and the quality of photography obtained with a certain exposure. In addition, it provides complete material for use in writing a continuity, if the amateur is that ambitious. At any rate it is a valuable aid in arranging the sequence of the scenes, writing titles before the film has been returned from the processing station, and generally preparing one's self for the task of editing.

The film to be edited should be projected two or three times so that the amateur may get an idea as to the general location of his scenes and the sequence in which he wants them to appear. A piece of white cardboard, 8 by 10 inches,

placed on one side of the editing table and the projector at the other, will be needed for this preliminary viewing of the film. Keep paper and pencil handy and make notes of the bad portions of the film and the pieces to be cut out.

Some movie makers stop the projector at the scene to be cut and insert a small piece of paper in the take-up reel. The paper contains a memorandum of the work to be done on the film, such as "cut out," "title," "tint," or other designation. Another helpful practice is to paste small stickers containing the number of the scene across a single frame at the beginning of the scene. Usually two or three frames are lost in making a splice, so the film will not be damaged. Make a note of the number of the scene and its place in the finished sequence.

If the beginning of the reel contains too short a scene, cut it out. A scene should run between four and five feet if it is to have sufficient time on the screen to be recognizable. Sometimes the amateur starts filming his scene before the paper leader has been run off. As a consequence, the better part of the scene is not recorded.

FOGGED SCENES—Another common fault is the light-struck or fogged scene at the end of the reel. This is usually caused by running the camera motor long after the protecting trailer has been wound on the reel. The reel is loosened somewhat and when it is unloaded in daylight, the light strikes it and fogs the last few feet of film. However precious the footage is, don't be afraid to cut it, as such a scene magnified on the screen is an eye-sore.

All under-exposed and over-exposed scenes should also be eliminated. The under-exposed scenes are too dark to show up to advantage and the over-exposed scenes are about on a par with fogged film when viewed on a large reflecting screen.

If the scene is too long to sustain interest, it needs cutting, so don't spare the scissors. A long scene is just as monotonous as a short scene is confusing. In editing a long scene, cut where the action is least noticeable.

If subtitles are to be interposed, make a note of this. Many times an idea for a title will come to you while you are projecting the film. Jot it down before it escapes you. When you have finished with the preliminary editing of the reel,

you will be in a position to judge just what must be done with it, what must be cut out, what scenes must be shortened, where the titles must go and what scenes must be transposed to maintain continuity and smooth sequence.

After this preliminary editing, some amateurs immediately cut out all bad portions of the reel and retain only those scenes that are to go into the finished film. They then lay the reel aside and proceed to write and make their titles or have them made by a professional studio. The making of titles has been discussed in another chapter.

NOTEBOOK AN AID—Sometimes, the amateur who has kept a notebook record of his scenes while photographing them is in a position to write and make his titles before editing, so that when he comes to this task his titles are before him, ready to splice into the film. Whichever method you adopt, it is good practice, as well as a time-saver, to have all your film before you as you start the work of cutting and titling scenes. You are then in a position to proceed uninterruptedly with your work.

The movie amateur will do well to save all the metal spools on which the processed film is returned from the laboratory. These spools are very handy when long films are being edited, such as a 1,000-foot travelog or a photoplay. A small piece of adhesive tape on each reel furnishes a writing surface for numbering the reel in ink. When you are breaking up the film for editing, wind the scene or scenes in the sequence on a spool. Then make a note of the number and content of the reel. The entire film can be broken up in this way, the reels sorted as to their logical sequence or the continuity in which you wish to project them, and the work of examining and splicing is simplified.

Another editing aid the author finds helpful for editing short reels is the spiked board. The board is a foot long and four inches wide, to give it stability. It contains two dozen 5-penny nails which have narrow points, driven through the board. When the film is cut up, the scenes and titles are placed along the board in sequence, simplifying the task of editing and splicing. The film is kept free from chance tangles.

In rewinding, do not allow the film to run too loosely over the reels. Rewind with the right hand at a steady, even pace, while the play in the left hand reel is steadied with a light but

firm pressure of the hand. Do not allow the film to run between the fingers or there is danger of scratching. Once a film is scratched, or cinched, it is impossible to restore it to its perfect state.

Cinching is caused by drawing the film tight after it has been wound loosely on the reel. A scratched or cinched film is enormously magnified when projected, causing the projection to be marred by "rain," or long vertical lines running through the film. With proper care, a roll of film can be run through the projector 600 or 800 times before it is too worn for good use.

PEG BOARD SCHEME—Still another method of facilitating editing is to take a board about two feet square and drill about 50 holes in it spaced two inches apart. Fit two-inch pieces of doweling into the holes and you have a rack which will hold several hundred feet of film ready for editing. As each scene or sequence of scenes is cut from the reel, it is trimmed at one end and scraped at the other and carefully coiled. Snap a rubber band about the coil of film and place it on the peg in its proper order. Then cut and scrape the title which is to lead the next scene and place that on the next peg. This operation is continued until the film is totally edited and ready to be spliced together. Usually the board will be found large enough to accommodate sufficient film to fill a 400-foot reel.

Other amateurs who want to do things in a hurry, without being bothered making gadgets to augment their purchased equipment employ the "egg box" method of splicing. All the scenes are placed in the little containers that come with the boxes. These containers are numbered and the scenes are placed in them in the order in which they are to be assembled.

The best advice is to select the editing method that appeals to you. Eventually you will devise one of your own which you will think is better than any that have been outlined here. If it suits you, that's the main thing.

A good splicing outfit is an essential part of the movie maker's equipment. Invest in the best. It will pay you in the long run.

But there is one sentence of advice that must be heeded if you wish to win a reputation as a good cameraman. It is this: Before you project—title!

CHAPTER IX

TITLE MAKING APPARATUS

 F course pictures should be titled. Our friends will enjoy them that much more. Properly titled pictures eliminate questions, explanations and apologies. Odd shots otherwise of no use can be made of real interest if titled in a fetching way. To make your own titles adds another kick to each shot.

And then the question: How to make titles?

Numerous title outfits are on the market and attractive titles can be made with all of them. If you possess a variety of such title boards and letters you can have a variety of ways of producing titles and subtitles so all your pictures do not present that sameness so noticeable when one style of lettering is seen on every reel of an evening's entertainment.

DeVRY TITLER—As there have been a great number of Model 57 DeVry cameras with f.3.5 lenses marketed within the last few years, the titler described here was designed to fit this camera, but with slight alterations and a little experimenting, it can be adapted to fit almost any other camera. Its light weight and folding features make it easily portable and capable of being stowed in a small space.

Obtain from any wood-working shop or lumber mill three pieces of three-ply half-inch veneered stock and have it cut to the following sizes: one piece $12\frac{1}{2} \times 10$ inches; two pieces $2\frac{7}{8} \times 17$ inches. Sand all edges smooth. Obtain 29 inches of three-quarter inch brass angle, also a two-inch brass butt hinge, two small brass hooks and screw eyes and six five-eighth inch rubber screw buttons; eight three-eighth inch No. 6 round head brass screws and two No. 6 three-quarter inch brass screws; two 18-inch brass or copper rivets. All of the foregoing except the wood and brass angle can be purchased at your local five and ten cent store hardware counter. While you are there you can pick up a large black marking crayon, a box of colored crayons and a 9×12 drawing book.

Take the two 17-inch veneered pieces and lay them down end to end and mount the brass hinge in the center, and screw on the rubber buttons on the same side with the screws furnished. Cut off $4\frac{1}{2}$ inches of brass angle and mount with two three-eighth inch screws against the edge. This is used for aligning the side of the camera. Turn both pieces over and screw on the two brass hooks and screw eyes over the hinge so as to lock both pieces securely. Drill a quarter-inch hole four and three-eighth inches from the end on which the brass angle is mounted and thirteen-sixteenth inches from the edge. This is used for mounting the camera with a $\frac{1}{2} \times \frac{3}{4}$ inch 20-thread round head brass machine screw. Shellac this entire assembly and set to dry.

Now cut up the balance of the brass angle in the following lengths: two pieces $3\frac{3}{4}$ inches with ends tapered; one piece $9\frac{1}{2}$ inches drilled for No. 6 screws; and one piece of $8\frac{1}{2}$ inches drilled for No. 6 screws.

After sanding down all rough edges of the $10 \times 12\frac{1}{2}$ inch piece mount the $9\frac{1}{2}$ inch brass angle along lower edge with angle outward, using four screws. Next mount the $8\frac{1}{2}$ inch

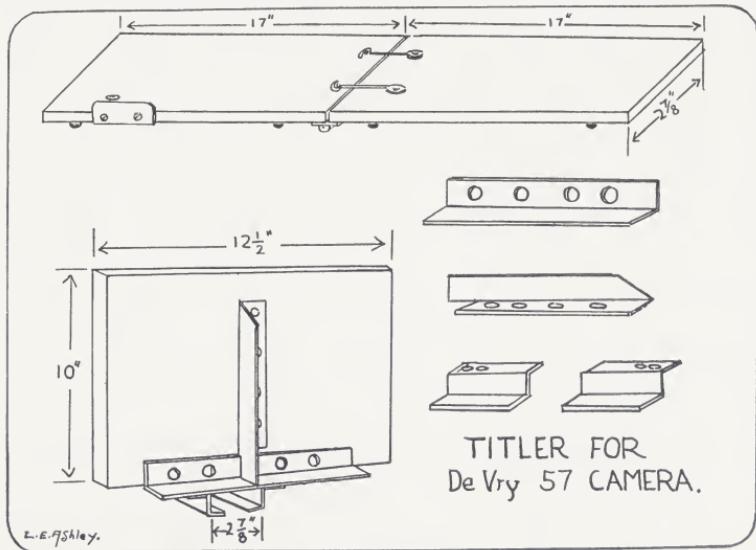


Fig. 6—Construction details of DeVrey titler.

piece in the center of the board with four screws also. This piece will have to be cut out on the end resting against other brass angle as shown in Figure 6. As the lens on this type of camera is not in the exact centre the other two small pieces of brass angle, after drilling, will have to be mounted against lower edge of board $1\frac{1}{8}$ inches off centre. Before mounting bend over three-sixteenths of the straight part of each piece. This will permit board to be moved freely back and forth on the hinged support and still hold it securely in place. After mounting these two pieces, shellac and set to dry. This completes your titler for the Model 57 DeVry camera.

MAKING AND DEVELOPING POSITIVE TITLES—Cut the stiff cover from the drawing book you purchased and lay out the inner side of same. With a large black crayon mark off the sketch shown with about a $3/16$ -inch line and cut out the entire centre of card along inner edge of this mark. This makes your mask. Next take a sheet from your drawing book and write, print or paint your title with black India ink.

Mount the mask on the back board with four thumb tacks and slide onto the folding rack. Mount camera with mounting screw at opposite end. Obtain a Model M Cine-Kodak portrait attachment from your dealer, also about half-inch length of $5/8$ -inch brass tubing. This tubing is for holding the portrait lens in place securely.

Positive film comes in 100-foot and 400-foot cans, but not on spools in the latter quantity. Therefore you will have to wait until dark or go into a dark room to rewind your film on spools for loading in the camera. This will also have to be done if you wish to develop your film in short lengths. A good plan is to obtain a small empty 25 or 50-foot spool and after mounting and threading your camera with the 100-foot roll, use the small spool for a take-up. A small piece of adhesive tape from the film can will help hold your film end on the small spool and also prevent film waste. Now slide your title in place and go into direct sunlight and set your lens at f.11.

Wind the camera, set the movable board exactly 22 inches from the face of the portrait attachment. Insert the crank in the side of the camera and press the button. Fifteen turns

of the hand crank counted are exactly three feet of film. Take your camera into a dark room and open it. Remove the small spool and press camera button to run off just enough film to reach lower take-up spindle again.

Cut off film even with lower take-up spindle. Take film from small spool and place in metal box that held roll of film. Attach end of film in camera to small spool with adhesive tape, close camera and you are ready to shoot your next title. Don't forget to close lid of film can securely before turning on white light. Don't shoot any title over six feet long as lengths greater than this are too inconvenient to handle without special developing equipment.

After shooting all your titles, you can start developing them at once, if you have a light-tight dark room to work in. Or you can wait until dark and then do your developing in the kitchen sink or cellar laundry.

A box of regular developer and a pound package of acid hypo, two glass or agate trays about $1\frac{1}{2}$ inches deep, will be needed for developing. Most any amateur photographer has these around his shop. Mix your chemicals as directed on packages. About two tubes of developer should be made up at a time. This makes about eight ounces of chemicals.

Remove one strip of film from can at a time and thoroughly wet under water. Then take hold of both ends at same time and pass back and forth through the developer. After the film comes up to the desired density, remove and wash with clear water. Place immediately in the fixing bath and pass back and forth until all whiteness has disappeared from the back of the film.

Remove and wash for 15 minutes in running water. Hang up to dry and you are ready to start on your next title. As soon as dry, the film may be spliced and projected.

TITLE BOARD FOR CINE-KODAK A CAMERA—While title boards have been produced for various types of automatic cameras, the Cine-Kodak A crank model seems to have been forgotten. This was one of the earliest 16mm. cameras placed on the market and still retains its popularity among advanced movie makers who prefer a crank model and tripod for their filming.

A home-made title board for the Cine-Kodak A, which will give good results when used in direct sunlight as well as with artificial light, is to be discussed here. If the movie maker prefers to make all his titles by artificial light, this board makes him independent of sunlight and he can photograph his titles when he wills.

The crank camera title board constructed by the author and used with fine results is shown in the diagram, Figure 7, the construction details of which will be given.

The board can be used in direct sunlight when available, or at night by the arrangement of the two spotlights. It can also be used for table top and miniature photography.

Titles set up on a title board, hand-painted on black or mottled cardboard, or black and white line drawings, animated cartoons—in fact any sort of title, drawing or sketch can be photographed with this board.

The title board can be constructed by anyone familiar with a hammer and saw. The materials needed are 8 feet of one-inch pine, 4 inches in width, for the uprights and cross pieces; a flat board 12 by 48 inches for the base; 4 feet of 2

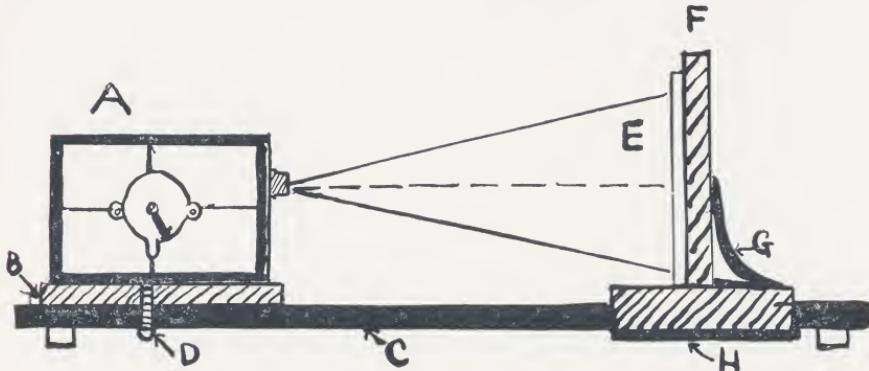


Fig. 7—Side elevation details of the Cine-Kodak A Titler. A, camera. B, one-inch pine length of camera to raise it to correct filming position. C, 48-inch base-board. D, set screw and washer to hold camera firmly to baseboard. E, title board or background to be photographed. F, upright support for title board. G, "L" bracket to strengthen upright. H, two by four joist legs support upright and enable photographer to move title board closer to or farther away from camera lens.

by 4 joist; 3½ feet of ordinary building pine 9 inches in width; 3 feet of 1 by 2-inch pine for bracing the camera; two 10-inch metal "L" brackets, some screws and nails.

The reflectors are two ordinary baking lamps equipped with handles. Instead of the 250-watt lamps which come with the reflectors, two 250-watt 120 volt Mazda G30 standard base spotlight lamps are used. Photoflood lamps can be substituted for this type of lamp, though, of course, the life of the latter is very short.

The reflec'ors come equipped with all the necessary wiring and plugs and are ready for immediate use with the lamps suggested. These lamps gave sufficient illumination to light up the entire title board or miniature "set" to be photographed at f.11 for depth of focus. The titles taken at this opening are distinctly in focus and perfectly lighted. The titles must be photographed at close range. If they are not, more than the title board will be in the finished picture. The title letters are only 1-inch high and will appear too small on the screen if photographed at a greater distance than 30 inches from the camera lens. The title board shown is the regulation celluloid letter and block board device. The slots accommodate the "feet" of the white letters.

The details of construction are shown in Figure 7. The rectangular frame at the right is 26 inches wide by 12 inches high and is made of the 4-inch pine. The 48-inch baseboard is fastened to the center of the lower frame. Allow enough space on the baseboard behind the cross piece to accommodate your camera; if it is of the Cine-Kodak A type it will need 9 inches.

Fasten the camera to the baseboard in any manner convenient to you. If you have an upright camera, an ordinary tripod screw will do, though you can brace the sides by building up a few inches of one-inch pine around the camera.

Figure 7 shows how the hand-cranked camera is thoroughly braced. The camera is raised to lens center position with the title board by 1½ inches of blocking. The camera will not be in exact center of the baseboard, since the lens is not in the center of this type of camera, but slightly to the right when facing the front of camera. This is compensated

for by moving the camera the same distance to the left as the lens is to the right center of the camera—about one inch. The title board will then be in the “lens center” when the board is properly lined upon the vertical rack in the rear.

Two 6-inch pieces of 2 by 4 joists are screwed to the extreme inner sides of the upper cross piece. These hold the spring clasps in any position found suitable for the lamps. The spring clasps used are ordinary steel tool holders sold in the ten cent store. They are used because they are handy in permitting the lamps to be taken off the rack in an instant when not in use, or to be taken off and used for other purposes.

The vertical rack in the rear, which is movable to allow for close-up titles and larger ones, or model work that requires a deeper “stage,” must be perfectly upright or the title board will lean forward or backward, distorting the perspective of the finished title.

The upright rack is built of two pieces of 9-inch pine joined together in the rear by cross-grain braces. The finished rack is 18 inches high and 20 inches wide, large enough for any title taken at the extreme length of the board. Two pieces of the 2 by 4 joist, 18 inches long, form the legs which slide along the outer edge of the horizontal baseboard. The upright is joined to the legs by two 10-inch “L” brackets, forming a perfectly rigid upright.

CENTERING TITLE BOARD—The title board best suited for this work is 12 inches high by 15 inches wide and is a solid black frame having two dozen interstices for inserting the movable white celluloid letters at various positions on the board.

To center the title board in line with the camera lens, place the rack over the horizontal baseboard, take a rule and draw a pencil line from the lens center to the center of the vertical rack. Mark the spot with an arrow about 6 inches from the top of the upright. Now measure the width of the title board to get the exact centre. Draw another arrow on the top of the board to mark the spot. When the two arrows are placed in position, the title board automatically will be centered each time it is placed against the upright rack for photographing.

When the title board is completed, give it two coats of flat black paint. This minimizes any reflections from the lights.

The board is now ready for use. Set up the title you wish to photograph on the board and place it against the vertical rack, the face of the board to be exactly 30 inches from the lens. Be sure that the title does not cover an area more than 11 inches wide and 8 inches high, centered on the board, of course. If the title wording extends too far to the right or left of the board, there is danger that part of the wording will not be registered on the film, or at least will be far off center and the title will be crowded up in one corner of the finished picture.

Place the reflectors in their respective clasps at either side of the cross rack on the title board. The whole board should rest on a flat, steady table to give sufficient working room. Insert the plugs into the nearest wall outlets (you may need extension cords if your wall sockets are not handy to the table). Light the lamps and focus them on the center of the title board. Each lamp will turn slightly toward the other and will flood the center of the title board with light.

Place the camera in the pocket on the board and be sure that it is clamped down right. The threaded screw on the tripod is ideal for holding the camera in position. If the screw is too short, obtain a bolt of exactly the same size thread but long enough to pass through the baseboard and up into the tripod receptacle on the bottom of the camera.

When the camera is securely in position and the lamps are lit, you are ready to proceed with the filming of the titles. If you are using a Cine-Kodak A, set the lens dial at f.11 and the distance dial at the lowest number—4. The title will then be in full focus.

Better control over exposure is obtained with the hand cranked camera, since the cranking speed is variable, but with the perfection of the motor cameras which have variable speeds of 8, 16, 24, 32, and 64 frames per second, little difficulty will be experienced in picking the proper speed.

At any rate the illumination is sufficient to make titles at f.11 if the camera is running at normal speed of 16 frames

per second. With the 500 watts of illumination and the lens stopped down to f.11, it is impossible to over-expose, but the tendency is to under-expose at normal speed. So if you can control the camera's speed to 8 frames a second so much the better.

If you are using a Model B Cine-Kodak, Filmo, Victor, or other camera with only a 16-frame non-variable speed, it may be wiser to open the lens aperture to a point between f.11 and f.8 in order to admit more light. This will not materially affect the focus of the title board. Neither must this be done when making titles with the board in direct sunlight.

DIRECT POSITIVE TITLES—All of the above title methods have indicated the use of a black background and white letters, the proper method for photographing on reversal film.

If the movie maker wishes to make direct positive titles, which, when developed are negatives, he must use a white background and black letters. When this positive film is developed, the white background becomes a black one, and the black letters become white ones. This is the important distinction between direct positive and reversal film titles.

If the movie maker wants to photograph his entire film on negative stock, and the titles the same way, so that the whole negatives may be printed as a unit after editing and titling, he must use a black background and white letters. The order of base and letter is reversed on the negative, but brought back to black base and white letter on the positive. Full directions for making and developing direct positive titles are given in the chapter on "Home Developing and Printing."

MAKING ART TITLE CARDS—Attractive title cards can be made without many hours of drawing, printing, and color blending by the simple method described here.

High grade poster boards in a variety of colors can be bought at your local printing house for ten cents each. These boards are large enough to be cut into several title cards, according to the dimensions of your titling board. Both surfaces of a poster board are usable, and 12 cards may be made from a single poster sheet.

The softer colors of cards should be chosen to avoid a displeasing glare on the screen. Light gray, tan, brick red, maroon, light green, light blue and other soft colors are suggested.

Obtain a supply of heavy blotter from an advertiser and a ten-cent package of stiff drawing paper from your stationer. At your corner grocery store ask for a breath-operated atomizer, such as is sold with a brand of insect killer. This should cost only a few cents. If you prefer a better one it may be purchased at any art store for 15 or 20 cents.

Several sheets of carbon paper will be needed, as well as a jar of paste and three or four bottles of colored inks. In buying the colored inks it is advisable to include red, green, yellow and blue, as they have been found to produce best results in this process. Very little black will be used except in drawing outlines and borders.

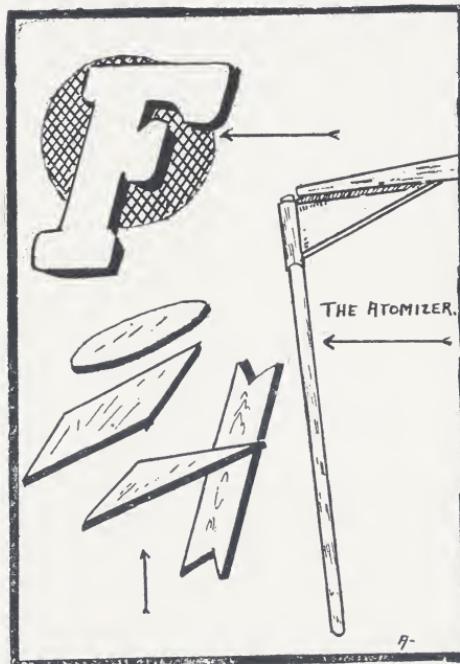


Fig. 8—Method of making spray titles. The letters are tracings.

Thumb through a batch of magazines carefully and clip out all letters of the alphabet and numbers that you think are of the right size to be used in titles. The alphabets should be transferred to the drawing paper, either by tracing or pasting. Now the drawing paper must in turn be pasted to the blotters and the letters cut out in detail. (Figure 8, upper left.)

True, the method seems rather tedious, but it is not half so tedious as hand lettering, and the alphabets, if pressed occasionally, may be used over and over again.

The scraps of blotters remaining from the alphabets are to be cut into many little circles, squares and triangles, or into any other shapes that might appeal to you. These are to be used to make the background. (Figure 8, lower left.)

Arrange your title on the card in the manner that you wish it to appear when finished, using thumb tacks or pins to hold the letters securely. **These should not be removed until the card is completed and dry.** Around the title arrange several of the circles and triangles. Let them overlap the alphabets in places and in some cases extend beyond the margin. Experience will teach you how to place them after you have made a few cards. Care must be taken to have all sections fixed against the poster boards.

Using the atomizer, blow a thin coat of the lightest colored ink on the card. Yellow is excellent for a base. When this is entirely dry, rearrange **only** the circles and squares and triangles, taking care to cover some places not covered before and to leave some places exposed that were covered before. This procedure should continue for at least three colors, arranged in increasing values, rearranging the circles, squares and triangles each time.

After a card has been completed, remove all pieces of blotter and put them in a safe place for use on your next card.

The letters may be outlined with black if desired. This is advisable if the title does not contrast enough with the background.

Borders may be hand-drawn with black ink, or they may be cut from colored paper and pasted on the card.

Picture for a moment an altar from which clouds of smoke float upward, filling the scene with an air of mystery. Suddenly a card upon which writing appears is seen to rise unaided from the depths of the altar, waver for a moment, then topple to the floor. Then another card appears and yet another.

Here are the directions for making these odd title cards yourself.

Cut a sheet of cardboard to fit snugly into your titling frame. Paste a sheet of light ray construction paper on it—the kind children use to make posters. Make sure the paper lies unwrinkled. The altar is also made of paper-covered cardboard, using another color paper to contrast with the background.

The altar may be of any size that is proportional to the background. Cut the altar similar to the lower right hand sketch shown in Figure 9. The tabs marked X X are left attached to the main body to fasten the altar to the background. Slits are cut in the background at just the right place to receive the tabs.

By experimenting a little before any slits are cut, the best location can be found. This is usually slightly to one side, as objects never look well in the very center. The bottom of the altar, having been folded back as illustrated, should be either pasted or pinned to the background. If your title frame is of a type that the altar must be removed before the card will slide out, it is best to use pins.

A short length of rubber tubing is inserted through a hole behind the altar. This is to blow cigarette smoke upon the scene. (See upper right hand sketch in Figure 9.)

Cut a number of small cards from a sheet of poster board. Cut the cards of a size sufficient to permit them to slide easily in and out of the pocket. Now, looking closely at the illustration, fix a length of thread at A. Run the thread over one card and under the next until the desired number of cards are utilized. Push the thread through a tiny hole in the background and out the back of the card. In the illustration, only three cards are shown, though a number of them may be used.

These cards lend themselves much more admirably to color movies than to monotone value pictures. However, excellent results can be registered on regular film with graduations of light and dark colors for striking effect.

GHOST TITLES—Motion demands attention. You've walked along a street peering into windows, wondering what they contained to interest you. Then as you pass on, you just as aimlessly forget what was in the windows. Unless you find one that contains a moving display.

"What makes it go?" you ask, your interest fully aroused. "I'll drop in and see."

It is the same with title cards. If they are made to move, interest in them is aroused from the first, and the audience will wish to know how you made them.

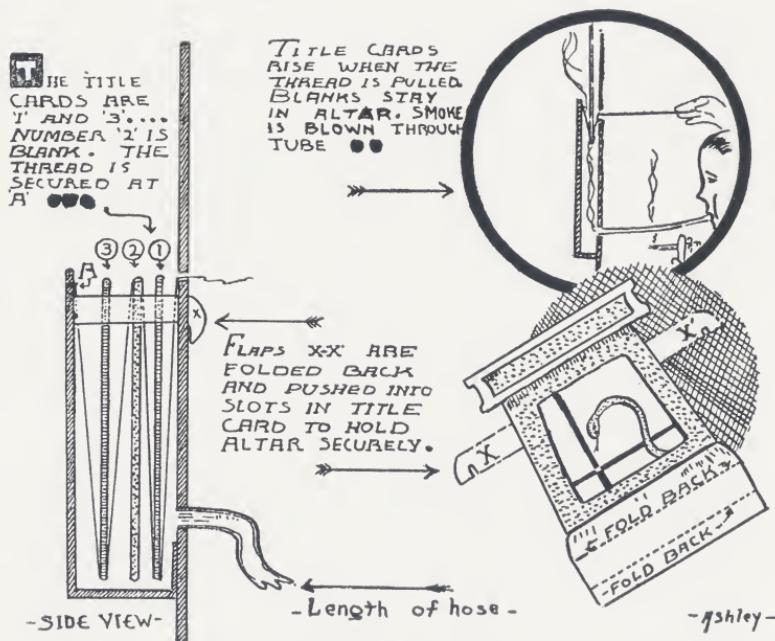


Fig. 9--Details of "ghost" title card.

When the thread is pulled slowly, every other card will be seen to rise from the altar. These should contain whatever title you wish to use. At the moment the thread is pulled, puff a cloud of smoke through the tube.

If a magician or ghost is drawn beside the altar, a very effective moving title will result (Figure 10).



Fig. 10—Adding a "spook" for greater effectiveness.

CHAPTER X

LIGHTING EQUIPMENT

TH E development of supersensitive film has done much to provide amateur movie fans with all year round picture making opportunities, but the cost of this film still holds many from using it as freely as they do panchromatic or semi-chromatic film.

The average amateur camera is fitted with an f.3.5 lens and has been limited in its ability to do good interior work without purchasing bulky and expensive high-powered lighting equipment. But the perfection of the photoflood incandescent lamp, and its low price, have enabled the amateur to make or buy lighting accessories at low cost and produce perfect interior pictures, even with some of the low-priced films.

The photoflood lamp is designed particularly for photographic lighting and is well adapted to amateur motion picture making. The lamp is designed to operate on regular lighting circuits of 105 to 125 volts and resembles the standard 60-watt inside frosted house lamp. Its extremely high operating efficiency causes its photographic effectiveness to be about equivalent to that of a 750-watt general service lamp and results in comparatively short lamp life—120 minutes at 115 volts. This, however, is sufficient lighting time to make 1,000 feet of interior pictures if the lamp is operated only while the camera is in action.

The light emitted by the photoflood lamp contains all the colors of the spectrum in an increasing amount, from violet to red. Thus, excellent results are obtained when using the regular panchromatic films. However, it is with the supersensitive panchromatic emulsions that photoflood lamps have their fullest applications. Because of the high efficiency at which the lamps operate, the color of the light is especially well-suited to the light-sensitivity characteristic of this film. Therefore, good color rendition is obtained without the use of filters.

REFLECTORS AID LIGHTING—For best results the photo-flood lamp should be used with a reflector which will collect its light and redirect it into areas where it will be most useful. A correctly designed reflector will increase the effectiveness of the lamp several fold. In general, one lamp in a reflector equals three or four lamps placed in home lighting fixtures.

In addition to greatly increasing the illumination in useful areas, reflectors possess the further advantage of increasing the size of the light source, thereby softening the shadows and improving the quality of the pictures. The new lamp makes it possible for the amateur to avoid costly failures and enables him to obtain satisfactory results, even with inexpensive cameras.

TABLE FOR SUPERSENSITIVE PANCHROMATIC FILM

Distance of Lamps from Subject	Opening of Lens or Diaphragm	Number of Lamps in Reflectors
4 Feet	f.3.5 or f.4	1
4 "	f.5.6 or f.6.5	2
6 "	f.2.8	1
6 "	f.3.5 or f.4	2
8 to 12 Feet	f.1.9	1
8 to 12 "	f.2.8	2
Around Room Without Reflectors	f.1.9	3 or 4
" " "	f.3.5	6 or 8

Doubling the number of lamps specified in the above table is about correct for regular panchromatic film.

When supersensitive panchromatic film is used, one photo-flood lamp in a reflector will furnish sufficient illumination for making excellent close-ups. Three or four of these lamps used without reflectors in ordinary ceiling fixtures and portable lamp units will enable the owner of an f.1.9 lens to film any subject in any part of the room of ordinary size. Care should be taken that direct light from a photoflood lamp does not enter the lens.

The data shown in the table is based on a camera operating at normal speed of 16 frames per second in rooms with medium colored walls and furnishings.

BACKLIGHTING—Interesting “backlighting” effects can be obtained by using an additional photoflood lamp in a shaded

table or floor lamp placed behind the subjects, or one of the lamps placed in a concealed position near the floor produces beautiful open fireplace reflections. Users are cautioned against allowing parchment, cloth or other inflammable materials to come into direct contact with the bulb while operating. For circuits fused for 15 amperes, as is the common practice in most residential services, no more than five lamps should be used on one circuit.

Where more than four of these lamps are used at one time, or two or more of the special reflector type lighting fixtures are used, it is advisable to run an extension cord of No. 14 rubber covered braided cord to an outlet as near the main house switch as possible, or to provide a special outlet direct from the main switch for this purpose. This will prevent overloading the house wiring.

In addition to using the correct amount of light to obtain good photographic reproduction, it is also essential that the light be properly directed and diffused to prevent harsh lighting and shadow effects.

In placing your lights, it should always be remembered that you are trying to simulate daylight or ordinary interior fixture lighting effects. Therefore, your light should be directed downward onto your subjects as much as possible or at an angle from high in front. This will materially assist in preventing deep shadows spreading over your subjects' faces or casting long streaks over a large portion of the background as happens when lights are placed too low.

Effects of this kind are sometimes desirable, as for instance, in taking a fireside scene similar to that shown in Figure 11. Here one or two of the lights should be placed right on the floor as near the opening to the fireplace as possible or directly into the opening.

A very natural flickering effect can be produced in this manner: Remove the guard from a small electric fan and attach a 24-inch piece of cardboard, cut in the shape of a five or six-pointed star, to the blades of the fan. Mount the assembly on a stand or box so that when the fan is operated the points of the star will pass in front of the light placed on the

floor. The fan should be of the variable speed variety and the slowest speed should be used.

If the scene is to be illuminated by the light from the fireplace only, or by a subdued light, then all your lights should be directed on your subjects from the fireplace side of the room.

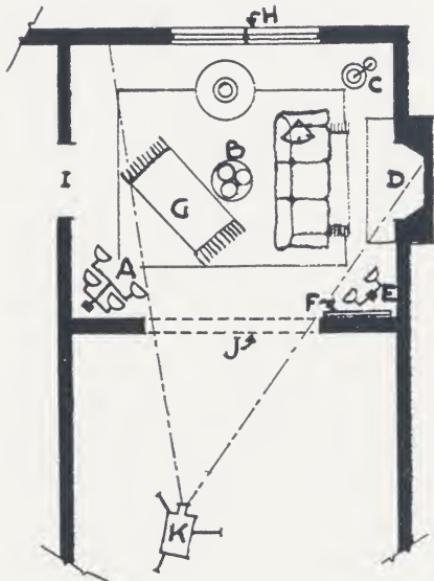


Fig. 11—How to Light a Large Room

Explaining the diagram: A is a four-light photoflood bank. B, ceiling fixture, 1 to 3 lamps. C, one photoflood in bridge lamp. D, fireplace. E, two-light photoflood bank. F, white oil-cloth reflector on wall. G, light colored rug. H, window. I, doorway. J, open space between rooms. K, camera. Lighting set-up is for f.3.5 lens and panchromatic film.

If you wish to produce the effect of one of your subjects entering the room and switching on the other lights, place a floor or table lamp in a prominent position and use a photoflood bulb in this lamp. Provide an additional lighting circuit plugged into a double or four-light photoflood fixture in combination with your ceiling fixtures. These lights should be operated from a point near the camera and be turned on at

the same time that subjects turns on floor lamp. The light from the one photoflood alone will not increase the total lighting of the scene very much. This same effect can also be reversed to stimulate turning the lights out.

Be careful in trying this effect to leave enough lights on to produce only a semi-darkness. Otherwise your film will be very much under-exposed and be too dark for projection.

MAKING LIGHTING EQUIPMENT—Another caution to observe in producing the fireside effect and flicker is not to continually switch your photoflood lamps on and off as this is injurious to the life of the lamps and shortens them considerably. The constant use of a good photometer is just as essential in taking interiors as it is when shooting in sunlight.

Many amateurs prefer to "roll their own" in providing their lighting equipment, although these units can now be purchased completely assembled at very low cost.

Here's how you can produce your own. The size and number of units required for good reproduction is to a great extent determined by the amount of space you wish to cover and also by the type of film used.

As most amateurs are interested in keeping down expense, this description will cover the use of regular panchromatic film and a camera fitted with an f.3.5 lens. Therefore, you should have at least two short floor type single reflectors, one high stand twin reflector and one four-light four-reflector high stand.

The floor type stands can be made by obtaining two nickled or chromium-plated reflector type heaters with the elements removed and photoflood lamps screwed into the sockets. Do not use the plain copper-plated type reflectors. These chromium-plated reflectors can be purchased for a dollar at most hardware or department stores.

The best and most portable bases for high lights can be provided by obtaining low-priced nickled folding music stands from a musical instrument dealer. The central music rack support rod should be removed and replaced with a rod having an eye bent into the top end through which a bolt and

wing-nut is inserted to hold your reflectors in place and provide a means of adjustment. Several different lengths of these rods should be provided to increase the value of the units.

For the four-light unit, a rod with two eyes must be spaced to accommodate the four reflectors.

DIFFUSION REFLECTORS—As large metal diffusion reflectors are rather bulky and also expensive, the use of plain white oil cloth is very effective in obtaining additional light and in the elimination of deep shadows. These are extremely light and portable and can be mounted on regular window shade rollers and also stored in a small space.

Transparent diffusion screens for these lights can be made at home by dipping white muslin or tulle in a solution of the following:

Hot Water, 30 ounces; Boracic Acid, 150 grains; Ammonium Phosphate, 3 ounces; Gelatine, one-half ounce.

Thoroughly saturate the fabric and allow to drip, then tack on frames to dry. Screens of this material can be mounted on shade rollers for easy storage.

Many amateurs believe that a lot of props are required to make pictures indoors, but this idea can be easily dispelled by a little judicious planning and proper placing of the camera lights.

Almost any average home containing two large connecting rooms with a good sized doorway or arch can provide the movie maker with from four to six separate scenes. By simply moving the location of camera and lights from one side to the other, or from one room to the other, and by re-arranging the furniture, drapery and pictures on the walls, a new set is created.

A glance at Figure 11 will make this clear. In making semi-long shots like these do not use a wide angle lens, for your regular f.3.5 will do very well. Use plenty of lights and keep a few spare photoflood lamps on hand for emergencies.

SUN REFLECTORS—The professional cameraman would not think of going on location to make exterior scenes without reflectors, mirrors and diffusers. They are essential equip-

ment to good photography. You no doubt wonder why your scenes are not as good. They could be better if you would use the same care the professional cameraman exercises.

Too many amateurs follow the old axiom: "Have the sun to your back and the subject facing the light." That program has been reversed in modern photography. Place your subjects so that the sun comes from the back, striking them at an angle. This gives you the back light that renders the pleasing effect of roundness and depth. Many amateurs will say: "Yes, but that leaves their faces in the shadow, and my camera pointing toward the sun". That's where the use of reflectors is called for.

Two pieces of wall board, about two by three feet in size, covered with a coat of aluminum paint, make ideal reflectors. Place one on each side of the camera to catch the sun's rays and throw them back on your subject. You will find that you now have the proper lighting conditions for exterior close-up work. A good sun shade over your lens will protect your lens from sun glare.

At times you will find that you desire to make your scenes with a certain background, but you will find the sun shining into the faces of your subjects. You cannot move the sun on location, but you can "move" the angle of the sun's rays.

A piece of thin white netting mounted on a wire frame will shield the direct sunlight from the subject to be photographed. To get back light, take a small mirror back of the subject, just out of range of the camera. You can pick up the sun's rays and throw a back light onto the head of the person to be photographed. When using a mirror, however, take care that the light is not reflected to the lens. This can be governed by a slight turning of the mirror. It is well, also, to have the mirror slightly higher than the subject so as to get the reflected light falling on one side and over the top of the head.

When photographing a girl subject, beautiful effects can be obtained in this manner: With a little patience in setting your mirror, you can create a halo effect in the hair that makes your picture stand out with vivid roundness. This is

also an excellent way of producing moonlight effects, but a deep filter must be used.

In making close-ups where you have what is termed "cross light" with a heavy shadow on one side of the face, use the reflectors on this side only. You will tone down the harshness and give your picture a more even lighting, which will result in detail in the shadows, as well as the highlights.

The next time you are puzzled as to how to light up the shadows, try using reflectors. You'll be surprised at the excellent results.

FLARE PHOTOGRAPHY—The movie maker has overlooked a good opportunity to obtain some novel pictures during the summer and early fall seasons if he has failed to make a few scenes with flares. What is more alluring than a crowd gathered about the camp fire at night telling weird stories or recounting the day's adventures?

Magnesium flares are especially manufactured for making night movies. They furnish excellent lighting for night photography in places where no current is available and are handy to carry and use.

Place one of these photographic flares in the ground and build a pile of wood around it, just as you would do if you were preparing a camp fire.

Now place the crowd around the flare, light it, and make the scene at full opening. The result is an unusually beautiful picture. The film can be improved if it is tinted red to give further realism.

One caution is to be observed when using flares. Never hold them in the hand. Magnesium burns are extremely painful. If the flare must be held high, attach it to a stick driven into the ground before setting it off.

Many novel pictures can be made with flares that otherwise might be impossible to obtain. The Carlsbad Caves, Caves of New Mexico, Howe Caverns and many other subterranean wonders have been photographed with flares.

CHAPTER XI

SOUND MOVIES AT HOME



F half the fun of making your own movies is in filming, editing and titling the pictures, then the other half is in the projection.

Projection calls for as much care as the actual making of the picture. In these days of sound and talking movies, ordinary silent pictures seem to fall "flat" when you have a group of friends in for dinner and a performance afterward. So why not pep up your showing of films with sound accompaniment?

The mere mention of sound may alarm some amateurs, for they have visions of expensive amplifiers, pick-ups turntables and speaker. But there are many methods of producing sound accompaniment for pictures if the amateur has not been able to equip himself with one of the professional 16mm. sound outfits. This chapter will endeavor to explain some of these methods.

The simplest method, of course, is the ordinary phonograph. Records can be selected which will blend with the type of picture being projected. Dreamy waltzes go well with travel pictures. Indian numbers harmonize with pictures of the Yellowstone and the Pueblo country. Hawaiian numbers lend the proper atmosphere to pictures of the islands. And so on, ad infinitum. A little ingenuity in the selection of the records and the amateur's music problems are solved.

But the difficulty with using the ordinary phonograph, whether it be a portable or console model, is that the sound comes from the position of the projector, rather than from the screen. For best effects, the sound should emanate from the vicinity of the screen, just as in the theatres. This can be done with a portable phonograph, but a helper is needed, and the records must be cued to fit the pictures being shown. In a pinch, this system works well.

USING RADIO FOR SOUND—Another source of sound is the modern electric radio. But the programs on the air at

the time you project never seem to blend with the pictures. So the solution is the record played through the radio.

All modern electric radios are equipped with phonograph pick-up outlets. All you have to do is plug the pick-up leads to the radio pick-up sockets and play the records on an ordinary portable phonograph turntable equipped with an electrical pick-up. The phonograph record's sound will come from your radio loud speaker. If the speaker is detachable from the set, it can be placed near the screen by lead wires. Then the operator can run the projector and sound from one point without help.

The more expensive radios, of course, are equipped with phonograph turntables and electrical pick-ups. A turn of a switch and the records can be played directly through the radio. Some of them even have microphones for making announcements and cutting heads for making your own records.

However, if you are forced to use a turntable and pick-up, in connection with an electric radio equipped with pick-up outlets, be sure to run your two pick-up leads to those outlets and not to the speaker jacks. A serviceable turntable can be made from an old crank model phonograph which can be bought at very little cost, and a pick-up, some of which sell for as little as two dollars. In this case, the phonograph must be wound up for each record.

MAKING A GOOD SOUND OUTFIT—The more advanced amateur, going in deeply for sound projection, can build his own equipment if he has a little knowledge of radio technique. For those who wish to spend some time and a little money on such equipment, the following details and diagrams may be of service.

This equipment was built from old radio parts which were gathered from six or seven discarded radio sets. The pick-ups, turntables and tubes had to be purchased, but all the rest of the equipment was home built. It has been in use for three years and has worked splendidly under all conditions.

The sound producing unit proper, the amplifier, is of the conventional amplifier design, employing one 280 power tube for rectification and two 171 amplifier tubes in push pull.

The amplifier works a loud speaker with far more volume than the 16 by 22 theatre can stand. This volume, however, is easily controlled by a potentionmeter on each pick-up. The merest whisper or the loudest notes are easily and instantly controlled by a turn of the dial.

BUILDING THE AMPLIFIER—A sketch of the amplifier design is given in Figure 12. The regulation radio symbols are employed and any amateur familiar with radio diagrams will have no difficulty in following the hook-up. Many radio stores sell amplifiers complete for use with pick-ups if the amateur has neither the time nor the inclination to build his own.

The parts needed for the 171 push-pull amplifier are as follows: 1 Thordarson R-480 power compact; 1 Thordarson T-2922 push-pull input transformer; 1 Thordarson T-2420 push-pull output choke; 1 Thordarson R-508-1 resistance unit; 1 R-280 condenser block (Dubilier, Tobe, Potter, Acme, Aero-

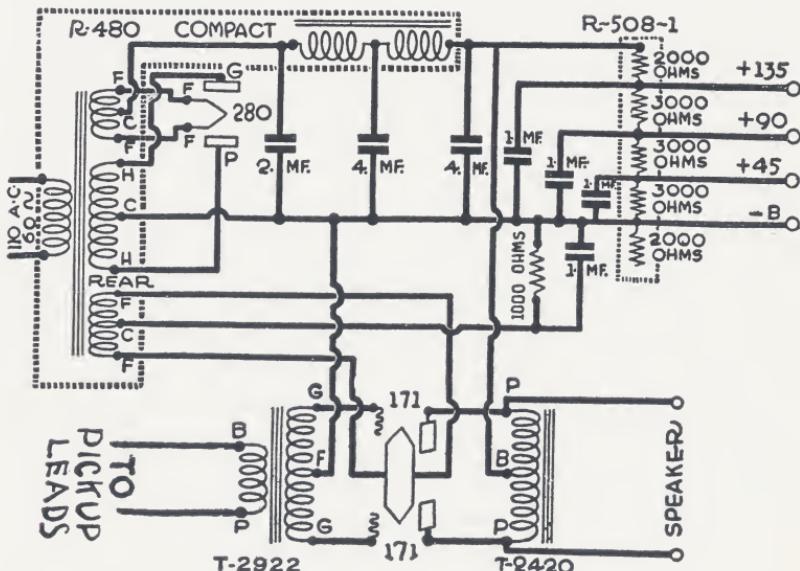


Fig. 12—The complete schematic diagram for the 171 push-pull amplifier for sound movies with turntable, pick-up and loud speaker

vox or similar type); 1, 1,000-ohm fixed resistance, 8 binding posts; 3 UX sockets; 2 pieces of bakelite 1x3x3/16; 1 piece bakelite 1x5x3/16; 1 wood baseboard 1x10x13; 1 UX 280 rectifier; 2 UX 171 power amplifier tubes; some hardware, solder and wire for connections.

The layout of the parts is shown in Figure 12. The amplifier unit can be enclosed in an old radio cabinet to make it dust proof.

HOOKING UP DOUBLE PICK-UPS—Two pick-ups and two turntables for the records enable the amateur to have continuous music with his pictures. The pick-ups can be connected by means of a double pole double throw switch, the leads of No. 1 pick-up running to the forward set of points of the switch and the leads of No. 2 pick-up running to the rear points of the switch. The leads from the two center points of the switch should run to the pick-up binding posts on the amplifier. (Figure 13.)

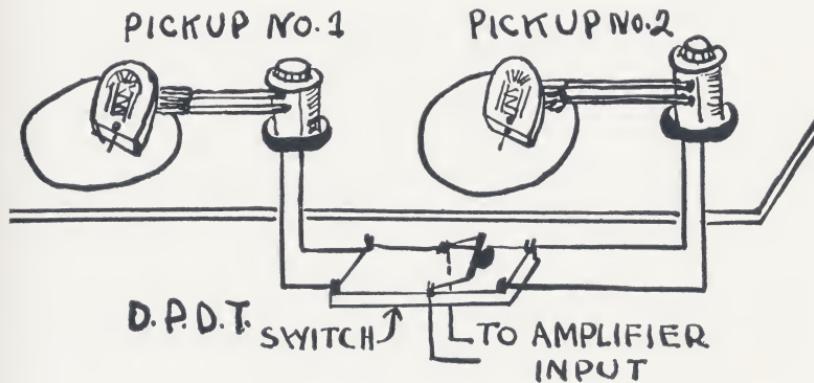


Fig. 13—How dual pick-ups can be used by means of a double pole double throw switch. This enables the showman to have continuous music and sound with his pictures.

ADDING A MICROPHONE—If you wish to hook up a microphone so that personal announcements may be made before and during the showing of your films, you will need a hand microphone, a $4\frac{1}{2}$ volt C battery and a microphone step-up transformer. The hook-up for the microphone is shown in Figure 14.

If the sound controls are mounted on a panel for convenience, a radio jack can be inserted. In this case one lead from the jack should go to one terminal of the C battery and the other lead from the jack to the primary of the step-up transformer. Connect the two microphone leads to a radio plug. This method makes it convenient to insert the plug and make announcements quickly.

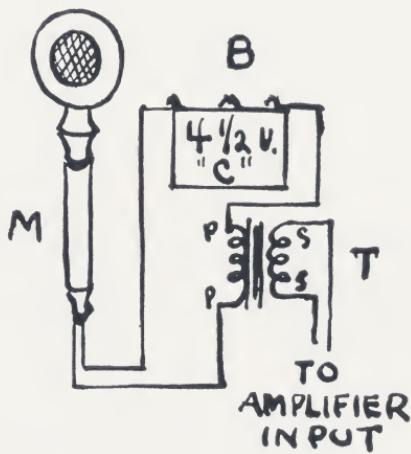


Fig. 14—Toe microphone hook-up. M is the hand microphone; B is the $4\frac{1}{2}$ volt "C" battery to supply current for the microphone button, and T is the step-up transformer to boost the output volume of the microphone before entering the amplifier.

CHAPTER XII

REVERSAL PROCESS EXPLAINED

THOSE making movies for the first time, and even some amateurs who have been making pictures for a number of years, are often puzzled as to the processes their films go through from the time the exposed film leaves their hands until it is returned ready for projection.

Many amateurs, having had some experience with making still snapshots, know that a negative must be obtained before a print can be made from it, with the type of film in use today. The film manufacturer advertising his reversal film tells the movie maker that the original film is returned to him. How can a film which has been exposed in a camera as a negative be reversed so that it will become the positive needed for projection? The negative, they know, turns an originally black object into a white object, and vice versa. A paper print is needed to restore the original relation between the two colors.

How then can this seeming miracle be performed on the same film? It will be well to devote this chapter to explaining the reversal process.

THE PROCESS VISUALIZED—This process is excellently illustrated in Figure 15 which is a drawing made from pictures taken through a microscope in the Eastman Research Laboratories. In Section A, we see the grains of the light-sensitive silver bromide in the emulsion, and in Section B are seen the cross-hatched grains which have been affected by light during exposure in the camera. They would not show any change to the eye, of course, because the change by light is not visible. The grains form what is called the latent image. Now, after development, these exposed grains turn into black metallic silver, and this is shown in Section C of the diagram. Then the bleaching bath removes all the silver, and it leaves behind the silver bromide grains which were not exposed, as shown in Section D. These are re-exposed and developed and make the final positive, as is shown in Section E.

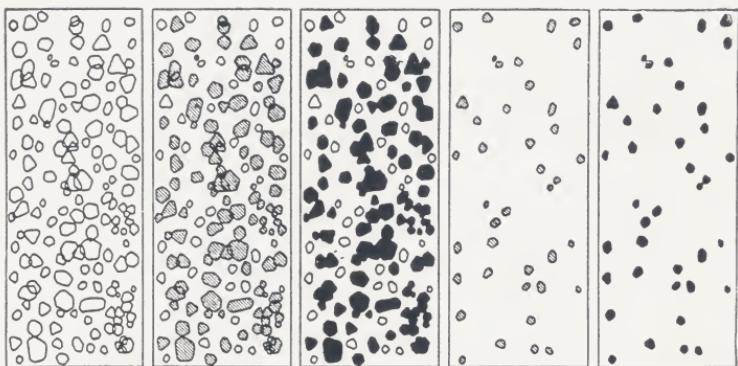


Figure 15—Diagrammatic representation of the reversal process.

In this reversal process, control of the results is obtained by regulating the second exposure in proportion to the amount of exposure given in the camera. Thus, if in the camera a heavy exposure is given, much of the silver will be developed at the beginning, and when this is removed, there will be only a small amount of silver bromide left to be used for the production of the positive. It is necessary, therefore, to give a very heavy exposure in order to make all this developable and so get enough density in the image. On the other hand, if the camera exposure is light, there will be a great deal of undeveloped silver bromide available to form the final image, and it is necessary to give only a short exposure, as otherwise too dense an image will be produced. This reversal process enables pictures of excellent quality, and with a very small amount of grain, to be obtained at low cost upon the 16mm. film so that the tiny pictures will stand the high magnification necessary for projection upon the screen.

Since 1923 the process has developed until now it is a considerable industry. The early apparatus has been supplemented by other forms of cameras and projectors, so that at the present time a wide range of extremely convenient apparatus made by several different manufacturers is available for the public. As a general rule, at the present time, the cameras are driven by spring motors which are wound up between exposures, and the tread of design is in the direction

of cameras as small and compact as possible, so that an amateur motion picture camera is little more than the very small and compact cameras used for still photography.

COMMERCIAL PROCESSING AUTOMATIC—The processing is done on automatic machines consisting of a number of tanks which carry racks with rollers, by means of which the film is fed continuously through the solutions. The machines are entirely automatic, the films being fed in as they come from the customer and taken out of the drying cupboard as positives ready for projection. As the film travels down the machine, it is first developed to a negative, the developed silver is then removed in a bleaching bath, the film is cleared of the bleach and resensitized, and it is then exposed to an extent dependent upon the original exposure and controlled by the optical density of the film itself.

The control is effected by the passage of the film between a source of red light and a thermopile. The current from the thermopile, produced by the heating effect of the red light passing through the film, controls a galvanometer vane which is interposed in an optical system by means of which a beam of white light is projected upon the film. Thus, the second exposure is dependent upon the current in the thermopile, and, therefore, upon the transmission of the red light by the film.

After this second exposure, the new image is developed as a positive, the film is fixed, washed and dried; all these operations going on as the film travels forward through the machine. In a little more than an hour from the time the film enters the machine, it is ready for projection. Each machine takes a new film every five minutes.

The Eastman processing stations are available all over the world, these containing more than a hundred of the automatic machines described above. At the present time, the traveler can get his film processed in Rio de Janeiro or in Japan or in China as easily as he can in New York, Rochester or Miami. In a few days, the pictures, ready for projection, are mailed to him by the station.

CHAPTER XIII

HOME DEVELOPING AND PRINTING

HE chief drawback to more widespread amateur motion picture making is the cost. The earnest amateur can make 16mm. pictures at a cost of \$1 to \$2 by following a simple method which requires apparatus which can be purchased for less than \$2.50. The time from camera to projection is less than half an hour.

All the amateur need do is purchase positive film in 100, 200 or 400 foot lengths, use it in his camera and develop it. He can then make prints from it, or he can reverse it and use the same film in his projector as he used in the camera. Positive film costs only \$3.60 per 400 feet when bought in rolls of that length. All the leading manufacturers like Eastman, Agfa, DuPont and Gevaert manufacture this positive film.

The directions for "doing your own" at home are simple and easy to follow. Most movie makers who have had a little experience in developing and printing their snapshot negatives are already familiar with the procedure, but for those who are not, the procedure will be outlined.

LOADING THE CAMERA—This consists merely of winding the positive film on 16mm. camera spool, just as the usual reversal film was wound on the spool. If you purchase the 400-foot rolls of positive film, you will need to go into a closet, using a "safe-light" flashlight or a safety green lamp, in order to wind the film on the 100-foot camera spools. The spools used by the manufacturers in returning the processed film for projection must not be used for this, as they have holes in them. Only light-proof reels should be used.

EXPOSURE—As positive film is about 5 or 6 times slower than negative panchromatic or reversal film, you can calculate the exposures accordingly or use the exposure table given below. The exposures given are at normal speed for summer use.

POSITIVE FILM EXPOSURE CHART

3 hours after sunrise and 3 hours before sunset

	Brilliant	Bright Cloudy	Dull Cloudy
Class I.—Beach, water, snow, airplanes, extremely distant landscapes	f.8	f.5.6	f.4.5.
Class II.—Landscapes with some sky, foreground important	f.5	f.4.5	f.3.5
Class III.—Street scenes, groups near landscapes, no sky close-ups	f.4.5	f.1.9	f.1.9

For winter, when the light is not as strong photographically, the schedule changes somewhat:

	Aviation and Water	Landscape Distance	Street Scenes	Close-Ups
Bright	f.6.3	f.4.5	f.4	f.3.5
Bright-Hazy	f.4.5	f.4	f.2.5	f.2
Dull	f.3.5	f.2	f.1.9	f.1.5

Use no filters. They are of no value. When in doubt, over-expose.

TITLE WORK—Titles may be made by typing the title on a card, photographing it in a title writer and developing as a negative. With an average of 10 frames per word, you have 400 words for \$1.00 in using the positive film. (Directions for title-making are given in Chapter 9.) The title is developed as a negative and spliced into place.

An X-ray tank is ideal for developing up to 100 feet of 16mm. film. Merely wind the film on an X-ray frame, emulsion side out and develop at 65 degrees Fahrenheit for 5 minutes. Rinse for one minute and leave in the hypo bath for 5 minutes. Then rinse in running water for 10 minutes and squeegee the film through a piece of wet chamois to another X-ray frame. It dries in about 10 minutes.

If you do not have an X-ray frame and tank handy, use any flat dish about two inches deep and 15 by 18 inches square. A hospital pan is cheap and you can see the image appear, and know when to stop development. A frame can be made of quarter-inch brass rod.

Wind the positive film developing frame tightly and when you dry the film, wind loosely to allow for shrinkage.

FORMULA FOR DEVELOPER—Formula No. 16 for devel-

oper is the old standby. This costs about 50 cents a gallon to make. Here it is:

Metol, 18 grains; Sodium Sulphite, 5 1/3 ounces; Hydroquinone, 352 grains; Sodium Carbonate, 2 1/2 ounces; Potassium Bromide, 50 grains; Citric Acid, 40 grains; Potassium Metabisulphite, 90 grains; Water, 1 gallon.

For a fixing bath the ordinary acid hypo is satisfactory. It may be purchased in the dry form already prepared for dissolving or formula F-1 may be used: Hypo, 16 ounces; Water to make 64 ounces.

Add the following hardener slowly as you stir the hypo solution rapidly.

Water, 5 ounces; Sodium Sulphite, 1 oz.; Acetic Acid (28%), 3 ounces; Potassium Alum, 1 ounce.

Of course the winding of the film on the developing rack and the actual developing must be done in no other light than a "safety" red or green flashlight or dark room lamp. The clearing by hypo may be done in any light.

Either the camera or projector may be used for printing or duplicating amateur cine film. Two hundred or four hundred feet at a time may be printed with the projector. The camera will print but 50 feet at one loading.

To use the camera as a printer, merely wind the positive film on the spool with the emulsion side of the undeveloped film against the emulsion side of the negative or the print, in the darkroom, of course. The shiny side of the developed film is toward the camera lens. Engage both films under sprockets and through the gate.

Take the camera out, hold it so the f.1.9 lens at full aperture is one-half inch from the side of an ordinary 15-watt electric lamp, than run the camera the full length of film. Take it back to the darkroom, unwind and process. If you used a negative, merely develop the yellow film as outlined above. If you used a positive, develop and reverse as later described.

USING PROJECTOR AS A PRINTER—To use a projector as a printer, place a 15-watt lamp in a box. The projector lens should be one-half inch from the bulb. Some care must be taken to prevent light reaching other parts of the film. If you place cloths around the gate of the projector, they will remove the danger of stray shafts from fogging the film. The box

containing the 15-watt lamp may have a safety light side. The two films are engaged in the sprockets and gate.

Load the projector so the film to be printed has the emulsion side against the emulsion side of the developed film. This is important. Run the projector at normal speed. Develop the film. Even with the 400-foot roll projection can be done within half an hour.

To develop and print at the same operation on the same film requires but little more effort than mere development. This process, known as "reversal," is usually a guarded secret. Here are the directions. Developer formula No. 16 given above is good, but any acceptable developer can be used.

The following developing formula has worked satisfactorily in winter and summer: Water, 2 quarts; Metol, 200 grains; Hydroquinone, 62 grains; Sodium Sulphite, $3\frac{1}{2}$ ounces; Potassium Bromide, 85 grains.

Just before you use this developer add one ounce of strong ammonia. Dilute developer 1:1 with water before use. This developer does not keep. It may be made proportionally without the ammonia and the ammonia added each time before using. The developing time of this solution is three minutes at 65 degrees Fahrenheit. It must be used in the dark. Do not use water that is "hard" or heavily chlorinated, as some of our friends have written of poor results. When in doubt use distilled water in all developing and reversing solutions.

REVERSING BATH—At the end of three minutes, the developed film is rinsed for one or two minutes in running water and then placed in a reversing bath. As soon as the film is in the reversing bath, the rest of the processing may be done in daylight or with ordinary lights. Don't use sunlight, as the film may be stained. Before the film is in the reversing bath one minute, expose all parts to a 100-watt lamp held about three feet away. Diffused daylight may also be used.

As soon as the blackened image is completely eaten away, as you can readily see by looking through the film, remove from the reversing bath and rinse for one minute in running water.

The reversing bath is cheap and can be used until muddy green. Here it is:

STOCK REVERSING SOLUTION—Water, 1 quart; Potassium Bichromate, 1 ounce; Concentrated Sulphuric Acid, 3½ ounces.

Use one ounce of the stock solution to 10 ounces of water. The temperature of the solution should be about 65 degrees Fahrenheit.

When the rinsing is complete, return the film to the original developer and develop in daylight or any bright light. Watch the development carefully. It usually takes about five minutes.

Now rinse the film in running water for one minute, squeegee between two pieces of wet chamois and dry rapidly.

The above process enables an amateur to make satisfactory pictures for about \$1.00 per 100 feet. He can make titles, art titles, or as many duplicates of films as he wishes; make master negatives of films and make as many prints as he wishes. It is simple to repair film torn at the edges by duplicating the damaged part.

CONTROLLING PRINTING—You can control printing after a little practice by moving a 15-watt lamp nearer or farther away from the camera. In case the film you are printing is very dense, it is wiser to use a 25-watt lamp as a printing light. If you use the projector as a printer, you can run it faster or slower, depending on the film density.

If you splice all dark films to be printed together and use a 25-watt lamp, or run the projector at slow speed, you can make perfectly illuminated film for screening.

Burnishing all film with a chamois wetted with carbon tetrachloride is necessary to make perfect prints.

For those who can afford it, of course, a commercial 16mm. developing outfit will save time and trouble. This outfit may also be used for reversing.

Select one brand of film and stick to it when you know its peculiarities.

The whole reversing process may be practiced with 6-inch or 12-inch pieces of film and a few soup plates. The more advanced amateur may want to "reduce" the density of motion picture film. This should first be done experimentally.

REDUCING TITLES—Printed or written titles can be reduced by immersing in the following solution and watching carefully to see that reduction is not carried too far.

FARMER'S SOLUTION—**Solution A**—Potassium Ferricyanide, 15 grains. Water, 1 ounce. **Solution B**—Hypo, 1 ounce. Water to make 32 ounces.

To use, take one part of Solution A and two parts of Solution B and 64 parts of water. When the film has been sufficiently reduced or cleared, place for a few minutes in a hypo solution or a fresh acid fixing bath to remove the yellow stain. Wash in running water, squeegee and dry.

REDUCING NEGATIVES AND POSITIVES—To decrease the density of either positive or negative film, ammonium persulphate may be used.

STOCK SOLUTION—Ammonium Persulphate, 2 ounces; Sulphuric Acid, $\frac{3}{4}$ dram; Water, 32 ounces.

To use, take one part stock solution and two parts of water. Watch the action closely and stop in an acid fixing bath. A good short stop bath can be made of one ounce of 28% acetic acid in 10 ounces of water. Wash for 10 minutes in clear water. Unfortunately, the action of ammonium persulphate cannot always be depended upon.

A proportional reducer is more satisfactory and gives uniform results.

STOCK SOLUTION A—Water, 32 ounces; Potassium Permanganate, 4 grains; 10% Sulphuric Acid, $\frac{1}{2}$ ounce.

STOCK SOLUTION B—Water, 96 ounces; Ammonium Persulphate, 3 ounces.

Use one part of Solution A to three parts of Solution B. When the film is sufficiently reduced, clear in a 1% solution of sodium bisulphite. Do not use a fixing bath. Wash for 10 minutes.

In case there is a tendency for the reversing solution to produce yellow stains, a 1% solution of sodium bisulphite will clear the stain. The reversing solution hardens the film so that rapid drying may be done by a blast of warm air against the squeegeed film.

Once in a while a reversed film is not entirely transparent after the second development. The hypo fixing bath may then be used and the film washed for 10 minutes.

CHAPTER XIV

MAKING ANIMATED CARTOONS

HE EQUIPMENT—Countless amateurs have seen and admired the cavorting and frisking of animated characters on the professional theatre screen. Many have attempted to make these animated movies themselves but few have succeeded. The more interested one became, the larger the obstacles in the path to success appeared.

Although requiring ingenuity and some ability to draw, the amateur who earnestly wishes to produce one of these novel presentations will find the making of simple animated cartoons is not as difficult as it appears.

The first thing to be considered is the necessary apparatus which must be constructed. Everything, of course, must be built around the camera. Most of the higher priced cine-cameras have a stop-motion device as an integral part of the mechanism by which single frames can be exposed. Other cameras can often be fitted with an attachment to accomplish that action. **This feature is absolutely essential.** If the camera is not the focusing type, a supplementary lens should be used. So much for the camera.

The stand for holding the camera and drawings in position is built from light wood. The base (A), Figure 16, can best be made by sawing out a piece of $\frac{3}{8}$ -inch plywood 14x18 inches. The upright (B) which suspends the camera above the base is 27 inches in height, 6 inches wide at the base and tapers to 4 inches at the top. This is fastened to the base by a cleat (C) ten inches from the front. A light brace (D) in back will hold the upright at a 90-degree angle to the base. Be sure that this last, especially, as well as the other measurements, is accurate. This is the easiest way to eliminate future trouble.

CENTERING THE COPYING FRAME—The camera is fastened to the upright with a small bolt which fits the tripod receptacle, so that the front of the lens is just 21 inches above

the surface of the base. A small block (E), Figure 16, curved to fit the camera will keep it steady and exactly vertical if a round magazine type is used.

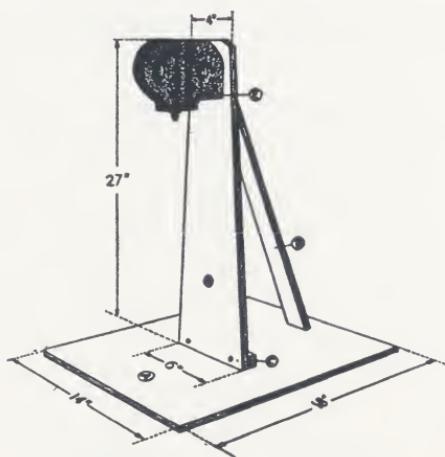


Fig. 16—Stand for animation work.

Next, draw a line on the base parallel to the front exactly beneath the center of the lens (Figure 17), and another diagonal to it down the center of the base. This is to center the $4\frac{1}{2} \times 6$ inch rectangle, referred to as the frame area, which is laid out from these centering lines.

Now, two round, wooden pegs (E and EE) Figure 17, are inserted one-half inch from the top of the frame area, that is, the side nearest the front of the base, and centered 5 inches apart.

For illumination, two 200-watt lamps mounted in coffee cans as shown in Figure 18 can be used. This sounds like a crude arrangement but it is very effective and costs no more than the price of the receptacles, bolts and wire. A board 16 inches long and about 3 inches wide hold the lights at an angle and is fastened 9 inches from the surface of the base.

The equipment necessary for photographing the drawings is now complete and should appear as in Figure 19.

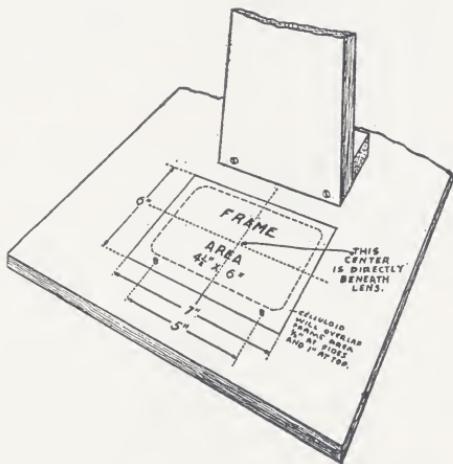


Fig. 17—Centering the base.

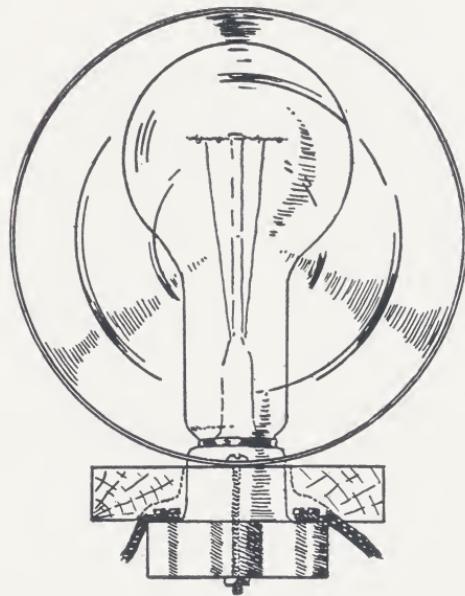


Fig. 18.—A pair of 200-watt lamps furnish the illumination.

ANIMATING—Effect of movement on the screen must be produced by a succession of drawings, each advanced slightly more than the preceding one.

The following supplies, for the most part found with ordinary drawing equipment, are necessary to start with: Drawing pen, pencils, art gum, etc.; waterproof India ink; tube of Chinese white.

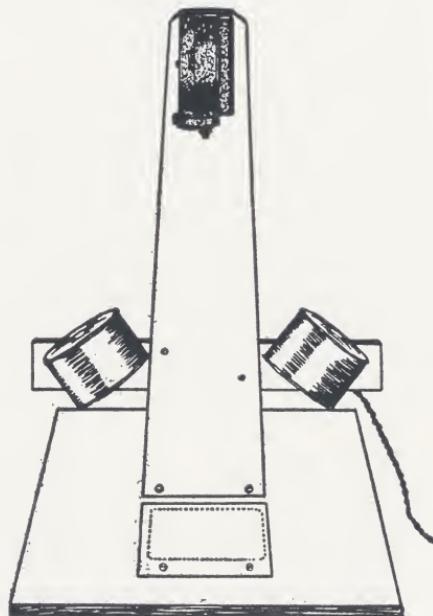


Fig. 19.—Layout of equipment for animating.

About fifty sheets of buff drawing paper, two dozen cel-luloid sheets, and two dozen sheets of black paper all cut 6x7 inches and punched at the top to fit pegs on the base of the camera holder.

Several sheets of buff drawing paper 24x5½ inches for panoramic backgrounds. (No holes.)

With this at hand we can turn to the process of animation. Let us first take up backgrounds. A background is an im-

portant detail, yet it should not be so elaborate that it detracts from the action. Simple backgrounds can be classified into two groups: motionless and panoramic.

The former is merely a sketch of a landscape, interior, city street, in fact, anything that comes to the artist's mind. This may be drawn on a sheet of the buff drawing paper, 5x7 inches, or, if a wash is used, light cardboard is better. The second type is a bit more complicated. It consists of a scene drawn on the size 24x5½ inches paper. The use of these backgrounds will be explained later under the process of photographing the drawings.

DETAILS OF ANIMATION—The details of the animation itself are harder to explain than the actual execution. For example, take a man driving a nail. The background might show a half-finished house. A saw horse could hold the board into which he is driving the nail. A pencil sketch of the man, minus his right arm, is now drawn on another sheet of paper. By holding the background and this sheet to the light, the position of the man can be determined. This is traced on a celluloid sheet with India ink and is made opaque by an application of Chinese white on the reverse side of the celluloid, keeping the Chinese white within the outer lines of the figure. This prevents any background from showing through the character.

USING THE BACKGROUND—Now take the background, this celluloid and a clean sheet of punched paper, line them up and hold to the light. On the clean sheet which should be topmost, draw the right arm, hammer in hand, in position above the head. Next, make another arm just a very short distance below the first. Continue to make arms until the hammer is low enough to strike the nail. Each of these arms should be traced on a separate sheet of celluloid, keeping them alike as possible. The backs, of course, should be opaqued. The celluloids should also be numbered consecutively beginning with the one showing the arm in its lowest position. The drawings are now ready to be photographed.

Place the background over the pegs on the camera stand. Next place the celluloid containing the drawing of the man over the background and finally, the arm celluloid, number 1. If they refuse to lie flat, a piece of clean photographic glass

will hold them so. Before you photograph, see that the camera is in focus, either by using a prism focuser, or piece of frosted film over the aperture after the pressure plate is removed. If everything is ready, photograph a dozen frames of the first movement. Then, replace number 1 celluloid with number 2 and this time, photograph only **two** frames. Replace this celluloid with number 2 arm celluloid and again expose two frames.

Repeat this procedure until the hand is raised above the head. Then start with the last celluloid and work **down**, at the rate of two exposures per movement. If you will repeat this action for several blows, your first animated cartoon is made!

FURTHER ANIMATING—Now let us take, for example, a figure walking, probably the most common action occurring in an animated cartoon. One step can be divided into four distinct motions as in Figure 20. Trace one of these on each of four celluloids, keeping the head in exactly the same spot on each celluloid and number consecutively. If a package or similar load is put in the figure's exposed hand, it will not be necessary to draw an additional four celluloids showing the advance of the other leg. The arm, of course, would not swing and the trouser legs would have to be black as in the illustration.

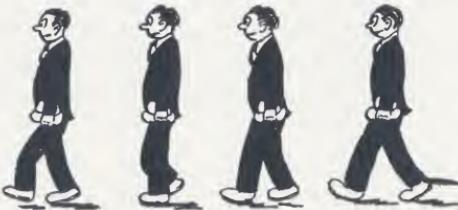


Fig. 20—Dividing a Step into four distinct motions.

It would appear, with only the legs in motion that the figure would make no headway, treadmill fashion. This, however, is taken care of by a panoramic background.

One of the long sheets of drawing paper is used for this. The drawing covers the entire length and may be a woodland path, a country road or anything your imagination directs. The length of the top is divided with light pencil lines, each division being equal to **one-fourth the distance of the length**

of the figure's step. This is important because it determines the distance the figure covers.

Now fit the top of the background strip against the pegs so that the left hand side, as it faces you upside-down, is just a little beyond the frame area. Make a little mark beside one of the pegs and adjust the background so that one of the division marks lines up with it. This will aid you in moving the background just one space with each change of celluloid. The sequence of the celluloids is, of course, 1, 2, 3, 4, and repeat, photographing two frames of each and moving the background to the left each time. The scenery will then appear to flow behind the figure as he walks forward. Figure 21 shows a complete set of eight numbered celluloids (embracing two steps) and a panoramic background. Note the division lines at the top.

Figure 22 shows a portion of the exposed film.



Fig. 21.—A set of eight numbered celluloids (embracing two steps) and a panoramic background.

A SIMPLE SCENARIO—Suppose we try a simple scenario. After the title, any title you wish to give it, a fade-in (or circle in) shows a barnyard in the early morning. A rooster, perched upon a fence post crows lustily two or three times. An old shoe comes hurtling past the early riser from the left. After crashing through several barn windows, it is finally brought to a stop when it hits the sleeping hired man. A fade-out of that person in a dazed condition completes the film.

Here is how to do it: First, the fade-ins (and outs). Take eleven sheets of black, punched paper, described in the list of needed materials.

Punch a small hole with a pin in the exact frame area centre. On the first sheet describe a circle, $5/16$ inch in the center. On the next sheet the circle is $15/16$ inch in diameter. Each subsequent circle increases $5/16$ inch **in radius**. Cut out the centers, retaining only a small margin outside the frame area on the four largest masks to hold them together. When photographing, run off a few frames of a solid black sheet, then start with the mask with the smallest hole and work up, photographing two frames for each mask until the frame area is completely uncovered.

The first background consists of everything described, that is, a barnyard, fence post and rooster, with the exception that the rooster's head is missing. This is supplied by four celluloids showing mouth, (1) closed; (2) one-third open, (3) two-thirds open, and (4) entire-

Fig. 22—A portion of exposed animated 16mm. film (enlarged).



ly open. The shutting of the mouth is accomplished by reversing this order.

The shoe is drawn and cut out of drawing paper and fastened with a tiny dab of paste to a strip of cellophane about $\frac{1}{2} \times 15$ inches.

PRODUCING THE ACTION—With this arrangement, the action of the hurtling shoe can be produced by moving the cellophane strip about one-quarter inch and photographing two frames each time. A sheet of celluloid should be placed over the shoe on the cellophane to keep it flat and in position.

To take the background for the second scene. This is best made by showing a front view of a barn. With a razor blade or sharp knife slit an inch or so along each side of the barn. Make another shoe in proportion to the size of the background, mount it on the cellophane strip as before and slip it in the slots on the background so that it will disappear in the barn and reappear on the other side. Expose two frames for each movement as before, being sure to give the shoe ample time to pass through the barn before it is seen coming through the other side.

The next scene could show another part of the barnyard, possibly an old shed. By manipulation of the shoe glued to the cellophane, that missile can be made to hit the shed, bounce off and fly out of the frame area.

The last background contains the figure of the sleeping hired man, minus his head and shoulders, sitting against a fence, tree or barn as your imagination directs. By means of a sequence of celluloids, the shoulders and the head can be made to rise and fall, rhythmically and slowly, while a hand-saw can be made to cut a log above his head in time with his breathing.

The shoe, still on the cellophane strip, hits the head and falls to the ground. The eyes pop open, the saw disappears. The eyes, however, shut again and the saw resumes its labor as the scene fades out.

CHAPTER XV

MOVIES IN COLOR

GNE of the most notable advances in amateur cinematography since its introduction in 1923 came in the spring of 1935 with the presentation to the public of two unusual color processes. One is Kodachrome made by the Eastman Kodak Company and the other is Dufaycolor, a product of Dufaycolor, Inc.

While both processes differ in some technical respects, they are similar in that they both permit the amateur movie maker to take color movies without the aid of any special filter device on the camera and project them without an attachment to the projector. The reason is a simple one. The color is actually in the film.

A resume of both processes, together with some exposure data on them, is given in this chapter.

How many times have you wished you could capture the image just as you see it in the finder? What would you have given to record all the beautiful colors of your last trip to the national parks, colors ranging from the softest to the most vivid hues? With the new cine color film this desire is easily fulfilled. All you need is a 16mm. camera, an average lens of f.6.3 or 3.5, no "gadgets" or technical ability. Movies in color is as simple as that.

It is actually easier to make good pictures in color than in black and white because you no longer need to imagine, before filming, how the colored scene will look in various shades of gray. If a scene is beautiful in the finder, the new color film will render it beautiful on the screen. No allowance need be made for loss of color. Thus, the scope of simplified movie making is enlarged to include types of colorful subjects that are utterly ineffective when rendered in monochrome. And, of course, scenes that make good monochrome shots acquire new vitality by the addition of color.

Now at last the amateur can capture in the film the beautiful green of summer foliage, the varied blues of sky and water, the rich reds of flowers, as well as the delicate flesh tones of human subjects, blue eyes and yellow hair.

Extreme closeups of flowers that result in large expansion of brilliant color on the screen are particularly spectacular. Also, close-ups of people are especially attractive, giving the effect of living portraits.

KODACHROME PROCESS—Kodachrome film reproduces all colors, being based on the three-color principle. Since the color is in the film, it is not based on an optical process. Three color filters, such as were introduced in the Kodacolor process, are no longer necessary and expensive. Neither are large aperture lenses required, as was the case in the Kodacolor process. Ordinary openings are used, with the exception that the Kodachrome picture making one stop larger than for black and white is required. The image is not broken up by small filter elements nor by the lines of embossed film. Ordinary 16mm. cameras and projectors with no special attachments can be used, and there is no restriction as to the focal length of either camera or projector.

DAYLIGHT EXPOSURES—For daylight exposures, Kodachrome is handled in the same way as ordinary film for black and white pictures, except that the next size larger diaphragm opening is used than for ordinary panchromatic (not supersensitive) film. Hence it does not require excessively large lens openings, with a corresponding loss of definition through decrease in depth of focus.

OUTDOOR LIGHTING—In color photography the lighting should preferably be of less contrast than for black and white pictures; that is heavy shadows should be avoided. Best results are obtained with the sun approximately behind the camera. The proper diaphragm opening for this kind of lighting is f.8. In some cases it may be necessary to photograph a subject lighted from the side; one diaphragm opening larger (f.5.6) is then needed to favor the parts of the subject not in direct sunlight.

In general, black and white pictures require contrasty lighting for pleasing effects, whereas with color film the colors supply sufficient contrast and thus **flat lighting** is more desirable.

FILTERS—Ultra-violet records in Kodachrome process as violet; therefore, when there is an excess of ultra-violet, which may occur in extremely distant scenes, snow scenes and those taken at high altitudes, the Kodachrome haze filter improves color rendition in this type of film. Furthermore, on a gray day, and in the shade the light is colder in tone, and the haze filter imparts a warmer tone to the colors. The Kodachrome haze filter is colorless. It should be used in front of the regular lens with no change in exposure. A three-screw device on these filters permits their being used with various types of lens mounts.

DAYLIGHT EXPOSURE TABLE

Brilliant Interiors	Subject very near window on bright days, but not in direct sunlight.	f.1.9
	Subject in direct sunlight.	f.3.5 or 5.6
Dark or in Deep Shade	Poor light. Forests, shaded porches, etc., with some light from sky.	f.1.9
Very Dull or in Shade	Average cloudy days.	f.2.8
Dull or in Open Shade	Average shaded scenes.	
	Sky completely overcast, but good light. Subject lighted only by large area of sky with some white clouds.	f.3.5
Slightly Cloudy	Sun just obscured, faint shadows cast.	f.5.6
Direct Sunlight	Full sunlight; overhead or at an angle, causing shadows on subject cast by subject itself.	f.5.6
Direct Sunlight	Full sunlight; sun behind camera, giving flat lighting with very few shadows on subject.	f.8
Intensely Bright	Unusually brilliant sunlight with light, high-reflecting surroundings, such as beach, snow, etc.	f.11

This table is for the hours from three hours after sunrise until three hours before sunset; earlier or later, use a larger diaphragm opening.

The above recommendations are for medium- and light-colored scenes; for dark-colored objects, use the next larger diaphragm opening.

INDOOR LIGHTING—In indoor color work, a slightly different technique is required. The subject should be about three or four feet from a large window which receives direct light from the open sky. If the subject is not in direct sunlight, use a diaphragm opening of f.1.9; if the sun is shining on the subject, use f.3.5 or f.5.6. Reflectors should be used to increase

the illumination in the shadows and to reduce the contrast between the highlights and shadows. A projection screen, a white cloth, or a large mirror can be used as a reflector; it should be placed at such an angle as to lighten the shadows in the subject. If the source of light is behind the camera, there will be fewer shadows and reflectors will not be necessary.

INDOOR COLOR FILMING AT NIGHT—Interiors of homes extend the field for unusually beautiful color pictures. Many opportunities are afforded for enhancing the beauty of indoor movies by the addition of color, because of the profusion of colored objects in the modern home. There are usually colors in rugs, drapes, furniture, lamps and ornaments which range through the spectrum. These may be the subjects, or the backgrounds, of your interiors.

Furthermore, indoor shots permit more opportunities for choice and arrangement of colors because clothing can be chosen to harmonize with selected backgrounds.

Making color motion pictures indoors by daylight is limited to areas near windows, and the light conditions outside must be quite favorable. Fortunately, however, indoor scenes can be photographed anywhere and at any time by artificial light. The new extra sensitive Photoflood lamps and reflectors of the Kodalector or similar type provide a convenient, inexpensive source of light which is not dependent on the whims of nature.

The New Kodachrome Film, Type A, is now available for use with artificial illumination. It has an emulsion that is especially corrected for the purpose so that NO FILTER is needed, as heretofore was the case with Kodachrome film for use with artificial light. It can be used with less light than the regular Kodachrome Film. "Daylight" or blue bulbs should not be used, because the pictures would be too blue. Similarly, arc-lamps that give a light which approaches daylight in quality would produce bluish results.

When making half-speed exposures the subjects should be cautioned to move slowly and deliberately, or the action on the screen will appear too rapid and jerky.

Be sure to measure the distance between the lamp bulbs and the important part of the subject. **The distance between the camera and subject has no effect on exposure.**

The tables given here are furnished by Movie Technicians and apply to Photoflood lamps when used with good reflectors.

EXPOSURE TABLE
For Cine-Kodak Kodachrome Film, Type A

Diaphram Opening and Speed	Number of Photoflood Lamps and the Distance from the Lamps to the Subject. The Distance should be measured or estimated carefully.
f.1.9 Half-Speed	2 at 8½ feet or 3 at 10½ feet or 4 at 12½ feet
f.1.9 Normal Speed	2 at 5½ feet or 3 at 7½ feet or 4 at 8½ feet
f.2.8 Normal Speed or f.3.5 Half-Speed	2 at 4 feet or 3 at 5 feet or 4 at 5½ feet
f.3.5 Normal Speed	2 at 2½ feet or 3 at 3½ feet or 4 at 4 feet

The light from all Kodaflectors must be superimposed on the subject, thus restricting the area that can be illuminated successfully by a few Photoflood Lamps.

Kodachrome is now made in 8mm. The interior and exterior exposure guides given here also apply to film of this width.

The different types of lighting are taken up in the chapter on lighting and the advice given therein can be applied to color pictures. One point to remember is the choice of background. If the background is to show in the picture, it will be necessary to have it close to the subject, or it will not receive sufficient illumination to record properly on the film. If it is not possible to have the background close to the subject, separate illumination for the background alone can be supplied by using additional reflectors.

A few bits of advice on the care of color film may not be amiss. When cleaning color film, be sure to use a film cleaner prepared especially for this type of emulsion. Cleaners containing alcohol are liable to remove some of the color from the film.

Kodachrome film is spliced in the same way as black and white film. It is not necessary to scrape off the bluish-green coating which is left after the emulsion is removed.

Kodachrome is now processed in the United States at the Rochester, N. Y., plant of the Eastman Kodak Company; in Chicago by Eastman Kodak Company, 1727 Indiana Avenue; and in Los Angeles, Calif., by Eastman Kodak Company, 1017 North Las Palmas Avenue. Processing laboratories will soon be opened in other cities.

DUFAYCOLOR PROCESS—Dufaycolor, which has been widely accepted in this country, is an English importation, being the result of long experiments backed by Spicers, Ltd., of London and Ilford Ltd., outstanding English photographic manufacturers, as well as other interests which provided the financial backing and technical guidance which made the process possible.

Dufaycolor has gone even farther than Eastman in that full color film is now available for practically every type of camera from Leica to professional movie cameras, and is furnished in cut film and roll film as well as in 16mm. motion picture film. Duplicate positive transparencies in these types of film can be made from the master positive.

The process takes its name from Louis Dufay who has been associated from the earliest days with efforts to produce color-screen film rather than plates, so that motion pictures could be projected in natural colors. In Dufaycolor the color matrix consists of regular areas of the three additive primary colors, blue, green and red, arranged in a geometrical pattern. Many plates having such a screen pattern have been made but the ease and regularity with which Dufay's invention can be applied to the manufacture of cine film in millions of feet has made it one of the most important advances in modern photography. The application of a microscopically fine screen, or reseau as it is called, to a film base by mechanical means on a regular and comparatively inexpensive commercial basis, particularly enhances its value as an acceptable medium for use in the professional motion picture field as well as all other branches of photography.

Dufaycolor film consists of ordinary film base of suitable thickness. Cellulose acetate base has been used exclusively

because of its safety factor, but similar results are possible with cellulose nitrate base. Upon this base is coated a thin layer of collodion which is dyed with one of the correct primary colors. By means of highly specialized machinery, microscopically fine lines are applied to the film with corresponding spaces between them. When the intervening spaces between these lines have been bleached and dyed one of the other primary colors, a grating consisting of these two colors results. By a similar operation a second series of lines is applied to the film at an angle of 90 degrees to the original lines and by a second bleaching and dyeing operation the third primal color is applied, producing a screen having approximately a million of these three-color elements to the square inch. The order of application is of no significance as long as proper balance of the three colors is maintained and the resulting screen presents on examination a neutral gray tone.

This reseau must now be coated with the emulsion. It is interesting to note that in the very early stages of color development the theorists visualized an emulsion that was truly panchromatic and had a high speed and very fine grain. As no such emulsion existed at the time, color experimenters had to mark time until the art of emulsion making could catch up with its theoretical requirements.

Emulsion making formerly depended upon controlling the balance of silver halide and gelatin characteristics, together with delicate manipulation of heating, digestion, washing, ripening, etc., with more or less crude equipment. Today those factors have been so well correlated as to establish a science; and emulsion making equipment has become practically standardized with automatic engineering controls that assure an accuracy permitting duplication of results within remarkably narrow limits.

EXPOSURE FOR DUFAYCOLOR—It is impossible to emphasize too strongly the necessity of correct exposure for successful results in color photography. Dufaycolor has wide latitudes, but careful timing is absolutely necessary to obtain the best results. No serious color photographer should attempt to work without some kind of exposure meter so that he may be certain that he is correctly judging the light conditions under which he is working.

Dufaycolor film at present has a speed approximately one-half that of standard panchromatic film and one-fourth that of supersensitive film. This means that the lens must be opened one stop larger than when using the standard pan and two stops larger than would be used in the case of supersensitive, or the time of exposure proportionately increased.

Depth of focus is of course markedly affected by the increase of lens aperture so it must be borne in mind that the camera should be very accurately focused in using the larger stops on Dufaycolor film. This film has a Scheiner speed of 18 and a Weston exposure factor of 8. Those using other types of exposure meters can no doubt correlate their readings with these figures.

FILTERS—No filter is needed for use with average subjects on medium and close-up exposures in daylight, but for distance scenes such as over sand, seascapes and snow it is desirable to control the excess of ultra-violet encountered under these conditions. For this purpose a Dufaycolor U. V. filter may be used on the lens without any change in exposure time. Excellent results can be secured on Dufaycolor film under artificial light conditions, by Photoflood or high power Mazda incandescent bulbs, providing suitable filters are used on the lens. Dufaycolor Filter No. 1A is for Photoflood and Photoflash (used in still work) and Dufaycolor Filter No. 1B is for Mazda incandescent bulbs. The exposure time must be doubled when they are used.

Dufaycolor film is processed in the United States by Dufaycolor, Inc., 30 Rockefeller Plaza, New York City.

CHAPTER XVI

MONEY SAVERS FOR THE MOVIE MAKER

HE amateur movie maker should be constantly on the alert to improve his camera technique and his familiarity with his equipment. A little thought and study now and then will save him many dollars in ruined film and repair bills. As a parting from these pages, the following helpful hints on the care of equipment and suggestions for better photography are presented.

LIGHT—Shoot across the light whenever possible so as to give shadows and depth to objects and subjects. Otherwise pictures will be flat and lacking in highlights.

Have the light at a point back of the camera, to the right or left.

For afternoon pictures, when the sun is in the west, point the camera northwest or southeast so that back light and shadows will be included. When photographing people looking towards the light, a portion of the head will be in the shadow.

If the face turns toward the camera, one-half will be in the light and the other in the shadow; and all inanimate objects will be seen half in the light and half in the shadow.

Light which is to be avoided is the light that comes from a point directly back of the camera and strikes the object full front. With the camera in this position no shadow will be seen and the object will have no relief. With the sun directly overhead, it is also difficult to get pictures in large open spaces in good relief. Move the action to a point where trees cast their shadows and some of these shadows can be included in the picture. Shadows give variety and action to a picture.

CLEANING CAMERA GATE—Because of the constant friction of the metal film track in the gate, small particles of the coating or emulsion are rubbed off the edges of the film and

lodge in the track. This deposit of emulsion, if allowed to remain, eventually will interfere with the smooth running of the film through the gates. When the particles of emulsion pile up in the track, the film is thrown out of the focal plane of the lens, thus causing the pictures to be indistinct or out of focus.

These emulsion particles are soluble in water. To clean the track, take a toothpick or wooden match and wrap one end in a small piece of lintless cloth. Slightly moisten the cloth and rub the track with it until the emulsion particles are entirely gone and the track is clean. Do not use any metal instrument to clean the camera gate. To do so may cause burrs and scratches which will mar the film passing through the gate.

CLEANING THE LENS—Take a toothpick and wrap a small piece of linen or lintless cloth around the point. Rub the lens softly with the cloth, taking care that the lens is not scratched by too great pressure. The rear element of the lens can be reached by inserting the toothpick in the aperture in the gate after removing the pressure plate. Do not use water or other liquid on a lens. There is a special Japanese lens cleaning tissue manufactured for the purpose. This is the most convenient to carry and use in the field.

WATCH YOUR HORIZON—Have you ever photographed a tall building from the ground and gotten the surprise of your life when you viewed the picture? You thought something must be wrong with the camera, for the building converged toward the top and looked like a pyramid.

The answer is simple. The camera has only one eye and that eye can play queer tricks with perspective.

When you photograph a building or a group of buildings, water scenes in which there is a horizon line, or any type of picture in which vertical or horizontal lines are prominent, take good care that the horizontal lines are exactly horizontal and that the vertical lines are exactly vertical, as you view them in the finder. Some of the newer cameras have the glass finder etched or are equipped with a pendulum to aid in holding the camera straight.

A great deal of film footage is spoiled because the camera has been tipped to one side or the other, throwing these lines grotesquely out of plumb, so that, for example, a high building sometimes looks like the leaning Tower of Pisa and a steamship climbs a steep hill of water.

This trouble may spoil an otherwise nicely panoramed shot, for there is a tendency to tip the camera to one side or the other during a long panorama. It is corrected in such cases by simply watching the horizon line in the finder and holding the camera so that it remains horizontal, or parallel with the top and bottom lines of the camera.

Vertical subjects can be kept vertical by lining them up with the side lines of the finder before pressing the release lever.

Watch your horizon.

HOW TO MAKE A SCENE RECORD BOOK—One of the most useful accessories the amateur movie maker can take along with him on a movie making expedition is the scene record book. Besides its usefulness as a note book for jotting down the description of the scene, it gives him much data to be used later in titling and editing the film. It also furnishes him with reliable data on the conditions under which the pictures were made, thereby increasing his knowledge of exposure.

Many times the exposure necessary to make a good picture is a problem. If the movie maker has no accurate exposure meter, he is sometimes in a quandary as to how to proceed in his filming. The scene record book is very helpful then.

There are several types on the market which can be purchased at a nominal sum, but to the amateur who likes to make some of his own gadgets, the scene record book described here is simple and inexpensive to make.

Ordinary 3 by 5 index cards are excellent for recording the exposure data. In one corner print the number of the card in one inch figures. (Figure 23.) If you want to do a neater job, calendar numbers can be pasted on each card, but use black numbers.

The card should be ruled to include such data as the location of the scene, the date on which the picture was made, the time of day, the stop number used, the distance, the light conditions and the type of lens employed, if your camera is equipped to take interchangeable lenses.

There is still plenty of room on the card for any remarks you care to jot down, such as an appropriate title. Often such ideas conceived on the spur of the moment are better than trying to write a title perhaps weeks later when the film is being edited.

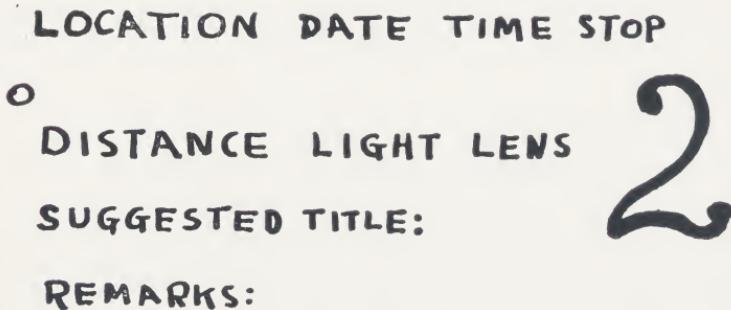


Fig. 23—A 3x5 index card offers a simple scene record.

Before you start to shoot the scene, hold the card containing the number of the scene before your camera and press the release button long enough to make just a few frames of the scene number. Most cameras will take the close-up within a foot of the camera, with portrait lens in place, or with focusing lens unscrewed as far as it will go. Here you have a definite record of the scene number on your film and no mistakes can be made later when editing.

After the film has been developed a list of titles may be made from the data contained on your record cards, which have been made in order. In editing your films, run the pictures through your viewing glass on the rewind. When you come to the proper scene number, splice in the accompanying title.

The usefulness of this simple record book lies in the great amount of data it contains. The photographer need not rely upon an elusive memory as to dates, time, exposure, and title suggestions. Everything is in his scene record book and his films contain the scene number which, of course, is clipped off in editing.

If you wish to keep the cards in a book, a suitable imitation leather cover can be purchased in the ten cent store. Just punch the needed holes on the narrow edge of the cards and clip them over the rings.

SOME HELPS—The movie maker interested in his hobby should get the best out of his equipment if it is to pay him dividends in the pleasure which can be found in such equipment.

He should keep abreast of the new things in the craft and learn the many tricks which can be done with his camera. Many costly mistakes can be avoided by reading good articles and books on the various phases of amateur movie production.

Several magazines devoted to the amateur movie hobby are published and are well worth reading for the helpful suggestions they contain.

“The American Cinematographer,” published in Hollywood, has an excellent amateur section.

“Camera Craft,” published by the Camera Craft Publishing Company of San Francisco, also has an amateur section and articles devoted to the craft.

“Movie Makers,” published by the Amateur Cinema League of New York is devoted exclusively to the movie hobby.

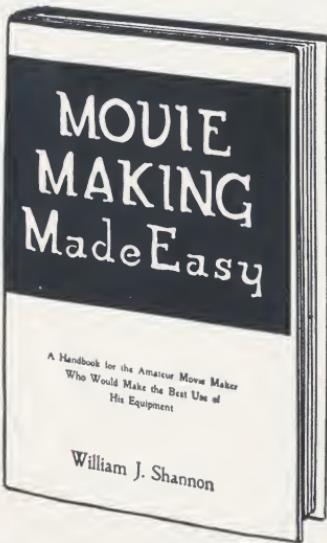
“Pocket Photo Monthly,” published by the Fomo Publishing Company of Sippo Lake, Canton, Ohio, is another magazine devoted to the amateur.

“Home Movie Magazine,” Hollywood, Calif., is another in the amateur movie field.

MOVIE MAKING MADE EASY

By William J. Shannon

50 CENTS



This book is right up to the minute with the latest data on the Kodachrome and Dufaycolor processes. There are many other chapters on the selection of a camera, care of film, trick photography, making your own title-making apparatus, care of the projector, animated cartoons with diagrams and instructions, formulas for developing and printing your own films, how to make interior lighting equipment, how to build an amplifier and pick-up for sound movies, editing and titling, filters and their use, lenses, money-saving tips and much other valuable information for the owner of an 8mm. or 16mm. movie outfit. 108 pages, 5x7 inches. Leatherette paper cover.

AMATEUR MOVIE PRODUCTION

By William J. Shannon

50 CENTS

The club unit contemplating a group production, wherein all the members may take part, is often faced with a lack of knowledge as to procedure. There are many details to be considered if the finished picture is to have that professional touch. It is the purpose of this book to point out the pitfalls and offer some suggestions of value to the beginner in this fascinating field. It tells how to organize a movie club, how to conduct contests; increasing club membership; hints on scenario writing with complete samples; movie tricks, make-up, etc. 64 pages. 5x7 inches. Leatherette paper cover.

AMATEUR
MOVIE
PRODUCTION

50 cents

William J. Shannon

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HOW TO MAKE MONEY WITH A MOVIE OUTFIT

By William J. Shannon

15 CENTS

How To Make Money With A Movie Outfit

A handbook for the owner
of amateur movie equipment
who wishes to cash
in on his investment.

By
WILLIAM J. SHANNON

15c

MOORFIELD & SHANNON
Publishers
Nutley, New Jersey

This booklet takes up newsreel work, insurance photography, filming for parties and clubs, editing and titling for others, selling film tests, municipal and industrial photography, projecting for others and other phases of amateur motion picture work by which the movie maker can turn his equipment into cash with which to buy additional equipment. 16 pages, 5x7 inches. Paper cover.

CAMERA TRAILS THROUGH THE SOUTHWEST

By William J. Shannon and Hannah M. Shannon

75 CENTS

A useful and interesting book for the vacationist and movie photographer, for it tells many interesting spots to see in our National Parks and through the Southwest. Here picture material abounds. It has 112 pages, 33 illustrations from photographs, and is a complete guide to some of the great natural wonders of America, any one of which is a paradise for the camera hunter who would "shoot" magnificent game and grandeur with a lens. 5x7 inches. Leatherette paper cover.

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CAMERA TRAILS Through the SOUTHWEST



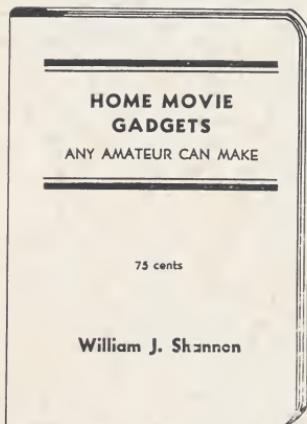
William J. Shannon
and
Hannah M. Shannon

75 cents

HOME MOVIE GADGETS ANY AMATEUR CAN MAKE

By William J. Shannon

75 CENTS



This is a great book for the movie maker because it brings to the amateur for the first time complete and detailed ideas for the construction of much of the equipment he will use in his home movie work. Here is a brief outline of the chapters in this new book in our Cine-Photo Series: Color Cartoons for the Amateur; Miniature Movie Sets and How to Make Them; Lighting and Processing Equipment; How to Make Home Talkie Equipment; Several Titlers and detail instructions for making them; How to Make an 8mm. adapter for a 16mm. Movie Camera; How to Make a Matte Box; a Lens Extension for Movie Close-ups; How to Make a Telephoto Lens; Wipe-Offs; Home Laboratory Stunts; for Processing Your Own Film; and a number of Miscellaneous Gadgets any amateur can make and use. The book is beautifully illustrated with 30 diagrams and photographs. Printed in blue leatherette paper cover, 92 pages, 5 by 7 inches, handy pocket size. No 8mm. or 16mm. amateur movie maker can afford to be without this book which will save him dozens of times its cost in constructing his own home movie equipment.

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